ELECTRICAL WEST

THE ALL-INDUSTRY MAGAZINE OF PROGRESS

McGraw-Hill Co. of California

SEPTEMBER, 1943

25c a Copy

Use them properly
KEEP YOUR ELECTRICAL EQUIPMENT IN FIGHTING TRIM
Keep it clean
KEEP YOUR ELECTRICAL EQUIPMENT IN FIGHTING TRIM
Oil it regularly
KEEP YOUR ELECTRICAL EQUIPMENT IN FIGHTING TRIM
Edison has a "Good-Neighbor" policy, too!

Even before the war, electricity made the farmer's working day more productive. And so it is today's Edison Company policy to serve its farm customers by helping them to keep their electrical "hired hands" in fighting trim. A service especially important in Southern California, because ninety per cent of the farms in Edison territory are electrified, and because of its contribution to the peak food production so essential today.

Reproduced here is part of a series of Edison "maintenance reminder" advertisements, now appearing in leading farm papers circulated throughout Edison-served territory. Farmers are again urged to keep electrical equipment clean and well-oiled; to use it only for the jobs it was built to do. Free booklets are offered on the proper use and care of electrical farm equipment.

SOUTHERN CALIFORNIA EDISON COMPANY LTD.

Waste in War is a crime. Do not waste electricity just because it is not rationed.

ELECTRICAL WEST (with which is consolidated The Journal of Electricity), September, 1943. Vol. 91. No. 3. Published monthly by the McGraw-Hill Company of California, 68 Post Street, San Francisco, 4, Calif. Entered as second class matter at the post office at San Francisco under the Act of March 3, 1879. Additional entry as second class matter at the post office at Los Angeles. Printed in U. S. A. Subscription rate in U. S. and U. S. possessions, and Canada, $2 per year; all other countries $3 gold (thirteen shillings). Single copy 25c.
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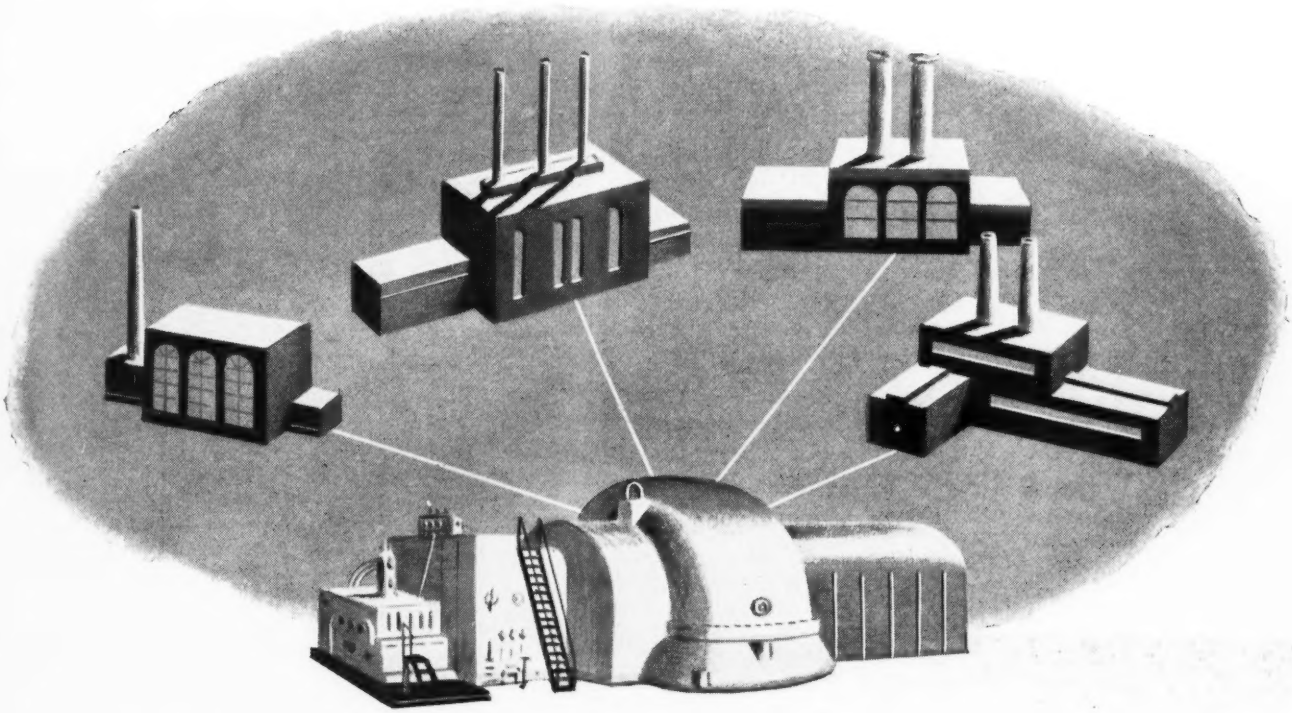
A NEW FIELD FOR CO-OPERATION

Shouldn't we begin right now to explore the possibilities of lower costs through simplification of your heavy power apparatus requirements? How far can the economies of repetitive manufacture be extended to power transformers, turbines, and other equipment which traditionally are "tailor made"?



THESE are questions which we believe open up an entirely new field for co-operative effort—a field with immense possibilities for postwar benefit.

Already, your industry and ours have worked together to save millions of dollars by simplifying the designs and ratings of lamps, watthour meters, distribution transformers. And with your help, G.E. has carried the economies of repetitive manufacture on into metal-clad switchgear—reducing prices as much as 35 per cent.

Similarly, we believe heavy apparatus such as power transformers, unit substations—yes, even turbines eventually—can be offered at lower price levels as the demand for "specials" is reduced. Moreover, there will be gains other than lower investment costs: better products, faster deliveries, and simpler installation.

A little booklet, "A New Field for Co-operation", states the issues and considers many of the questions you'll want to raise. It outlines the course of action General Electric is prepared to take—with your co-operation. Your local G-E representative can supply copies for you or your associates. *General Electric Company, Schenectady, N. Y.*

GENERAL ELECTRIC

201-101

The best investment in the world is in this country's future—BUY WAR BONDS

Here in the WEST

People

H. J. Chanon

who writes of "tailored" lighting for maximum production (p. 46) came to the West Coast from Nela Park a year ago to specialize in design of lighting systems for southern California war plants. In his new work, he also advises on blackout and in wartime motion picture production. An authority on "black light", he has applied this knowledge since Pearl Harbor to home defense and Army and Navy needs. Previously he had served as street and highway lighting expert at Nela Park and helped in design and installation of the Chagrin Falls, Ohio, high-visibility highway safety lighting system, which embodies the "admiral's hat" reflector with a bar-filament lamp.

D. P. Kohler

is lighting specialist for the agency and specialties division of Westinghouse Electric & Mfg. Co. at Los Angeles. He joined Westinghouse in 1937, while a graduate student in Mansfield, Ohio. Early in 1938, he was made salesman for the Supply company at Cleveland. Kohler was transferred to San Francisco during the Golden Gate Exposition to handle personnel work for the Westinghouse exhibit. He writes this issue (p. 52) of the three sources of light and where to use each.

Pages

Plan Now For Postwar Lighting Promotion.... 43
By O. R. Doerr—Practical suggestions for a workable program.

Critical Seeing on Critical Materials..... 46
By H. J. Chanon—Maximum production and reduced waste of materials requires tailored lighting, especially for difficult inspection.

Three Sources Used in Wartime Lighting..... 52
By D. P. Kohler—Incandescent, fluorescent and mercury have individual characteristic, seeing and economic advantages; where each should be used.

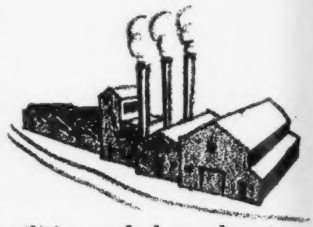
Dutch Flat Designed as Fully Automatic..... 60
By T. J. Corwin and D. P. Dinapoli—Factory assemblies used to cut labor costs in 27,500-kva. PG and E hydro plant.

Appliance Service Directory..... 69
Letters 8
Books 12
New Products 16
Bulletins 38
Lighting 46
Engineering 60
Sales 68
Associations 76
Editorials 74
On the Beam..... 82
News 84

Cover photo: Westinghouse 40 and 20-watt Mazda F lamps in special portable fixtures illuminate cargo plane "caverns" at Douglas Aircraft Co's Southern California plant

Preview

Industrial Electrification



is the theme of next month's issue. The West has witnessed a growth in industries during the past year or two that is so big it is a military secret. Facts and figures on this growth must wait until hostilities end, but what *is* important today is that this industrial electric machinery deliver its utmost, last long under continuous use and be improved by the ingenuity of American initiative and enterprise. To get more out of every ounce of copper and produce more with existing equipment will be the aim of the informative contents of the October ELECTRICAL WEST.

Fire Fighting

at utility stations does not necessarily require expensive equipment, in the opinion of Hawaiian Electric Co. officials. Essentials are rather the proper kind of equipment, kept in good condition and in the right place, plus men trained to use the equipment and to bring it into service immediately. A discussion of this important phase of wartime utility operation by a member of the Hawaiian Electric staff will appear in the October issue.

Supervisory Training

takes on even greater importance in wartime, with resulting rapid turnover in

personnel. How Puget Sound Power & Light Co. is handling this problem will be told next month.

Harbor Steam Plant

of the Los Angeles Bureau of Power & Light is the West's newest and largest steam electric generating station. Electrical features of this plant will be discussed in the next issue.

An Entire System Depends on a Forging

At present the forging industry is all-out for war. However, BTC Forged Hi-Line Hardware has been ruled too vital to suspend – even temporarily. A perfect example is shown in the Forged Steel pins illustrated above.

Your heaviest hook-up is only as strong as the pins that connect the insulators. These small pins are always steel. Ask any insulator manufacturer.

Through Your Insulator Manufacturer Only

Transmission Line Hardware

BTC

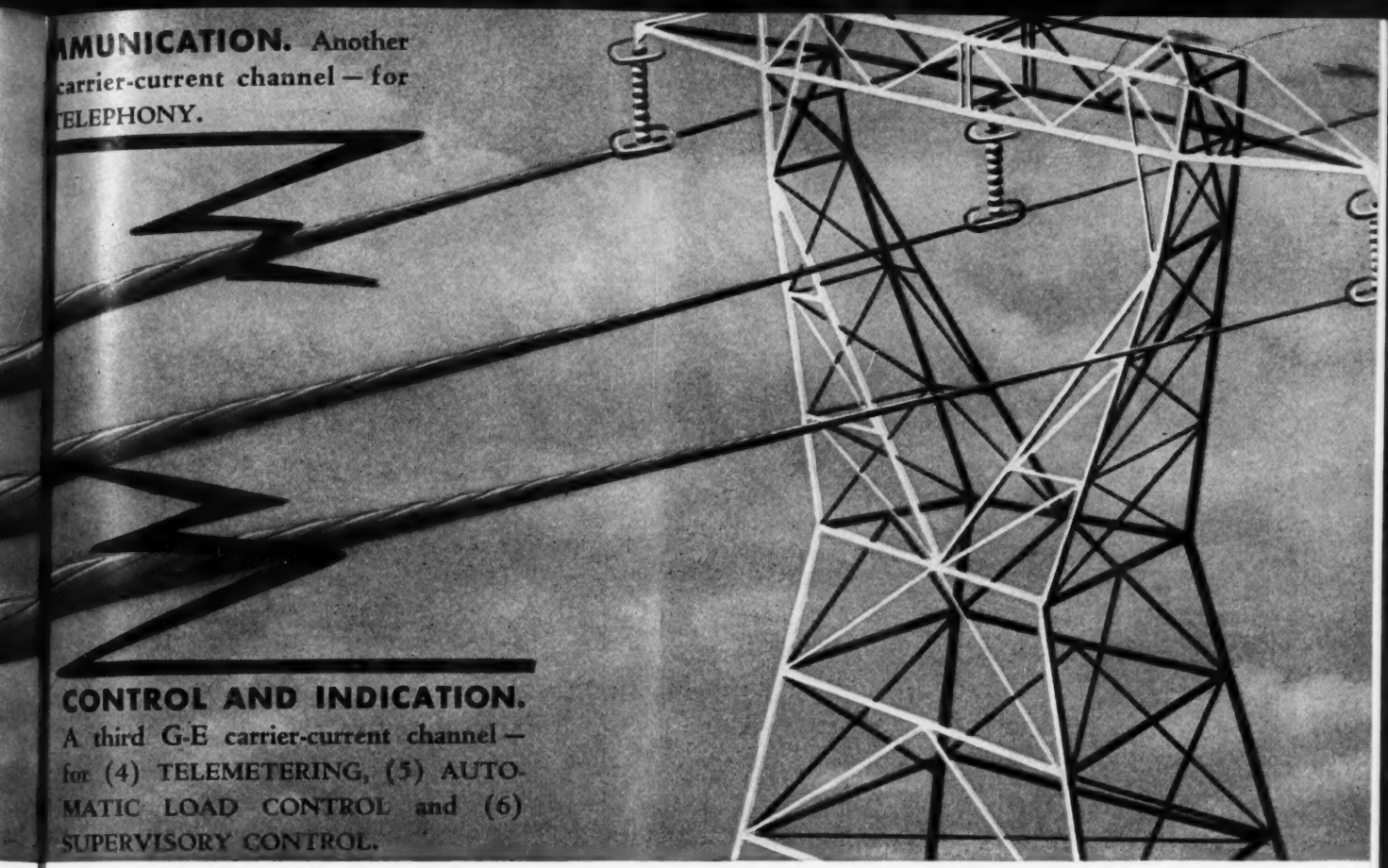
THE BREWER-TITCHENER CORPORATION – CORTLAND, NEW YORK

typical services over one line!

An example of 6 important functions performed through 3 G-E carrier-current channels using 1 power-transmission line

GENERAL ELECTRIC

151-BS-6920


MMUNICATION. Another carrier-current channel — for TELEPHONY.
CONTROL AND INDICATION. A third G-E carrier-current channel — for (4) TELEMETERING, (5) AUTOMATIC LOAD CONTROL and (6) SUPERVISORY CONTROL.

Protection — communication — control — indication. Without separate wires! Without the use of vital war materials for new wire-line construction!

Protection that virtually "beats trouble to the punch". . . spots faults instantly . . . isolates them quickly . . . thus permitting the remainder of the system to maintain service. May allow heavier loading of lines—*safely*.

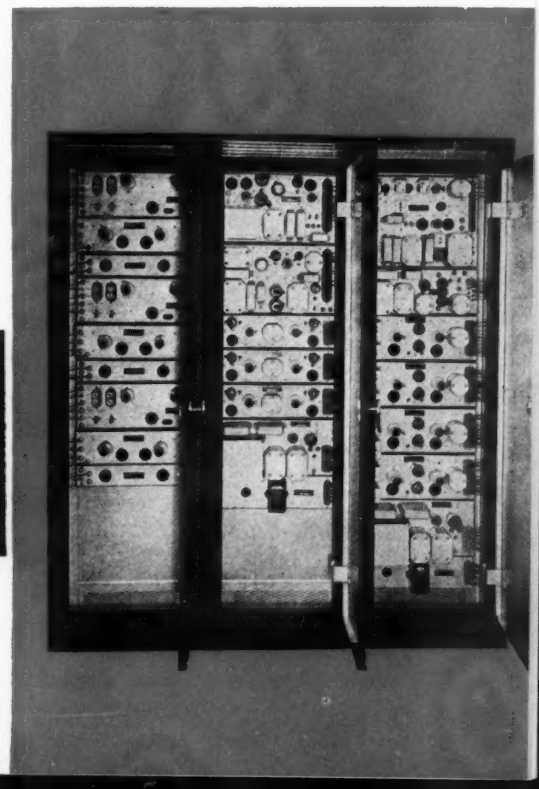
Communication that saves many miles of telephone-line construction. Stands up through storm and catastrophe. Keeps men and machines under the unified guidance of the load dispatcher.

Control and Indication. *Telemetering* that brings load readings on system-wide transmission lines right to the desk of the chief load dispatcher. *Load control* that automatically regulates the power flow over important lines by controlling a selected generating plant. *Supervisory control* that affords supervision of remote stations, eliminating need for full-time attendants.

These offer a quick glance at the principal carrier-current services used by power companies. They are modern means of power-system control. . . . They open the road to better operation and improved economies.

No matter whether you need one or many carrier services, you can get each in a "packaged" standardized design — including coupling capacitors and line traps. *And with the high quality and dependability that only thorough manufacturing, application and installation "know-how" can assure!* General Electric has 20 years of successful research, development and practical experience in this field. Call in a G-E engineer—whether on plans you have on foot or merely for preliminary information. *Electronics Department, General Electric, Schenectady, New York.*

Tune in "THE WORLD TODAY" and hear the news direct from the men who see it happen, every evening except Sunday at 6:45 E.W.T. over CBS. On Sunday listen to "The Hour of Charm" at 10 P.M. E.W.T. over NBC.

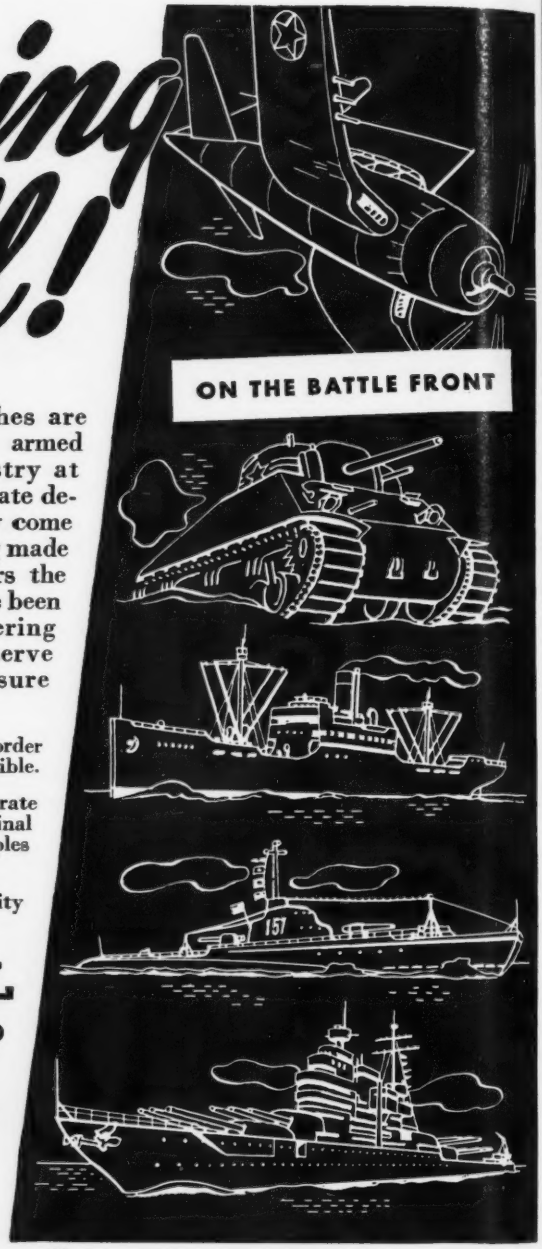


GENERAL ELECTRIC HAS PLANNED AND BUILT MORE CARRIER-CURRENT EQUIPMENT NOW INSTALLED THAN ALL OTHER MANUFACTURERS COMBINED

CARRIER CURRENT

THE NERVE NETWORK OF THE POWER SYSTEM

Serving Well!



"NATIONAL" Brushes are serving well with our armed forces and with industry at home. While the immediate demands of the emergency come first, every effort is being made to give all our customers the service to which they have been accustomed. When ordering "National" brushes observe these precautions to insure prompt delivery.

1. Anticipate your needs and order as far in advance as possible.
2. Give complete and accurate information on your original purchase order. Include samples and drawings when necessary.
3. Secure best possible priority rating.

NATIONAL
TRADE-MARK
CARBON, GRAPHITE AND METAL-GRAPHITE
BRUSHES

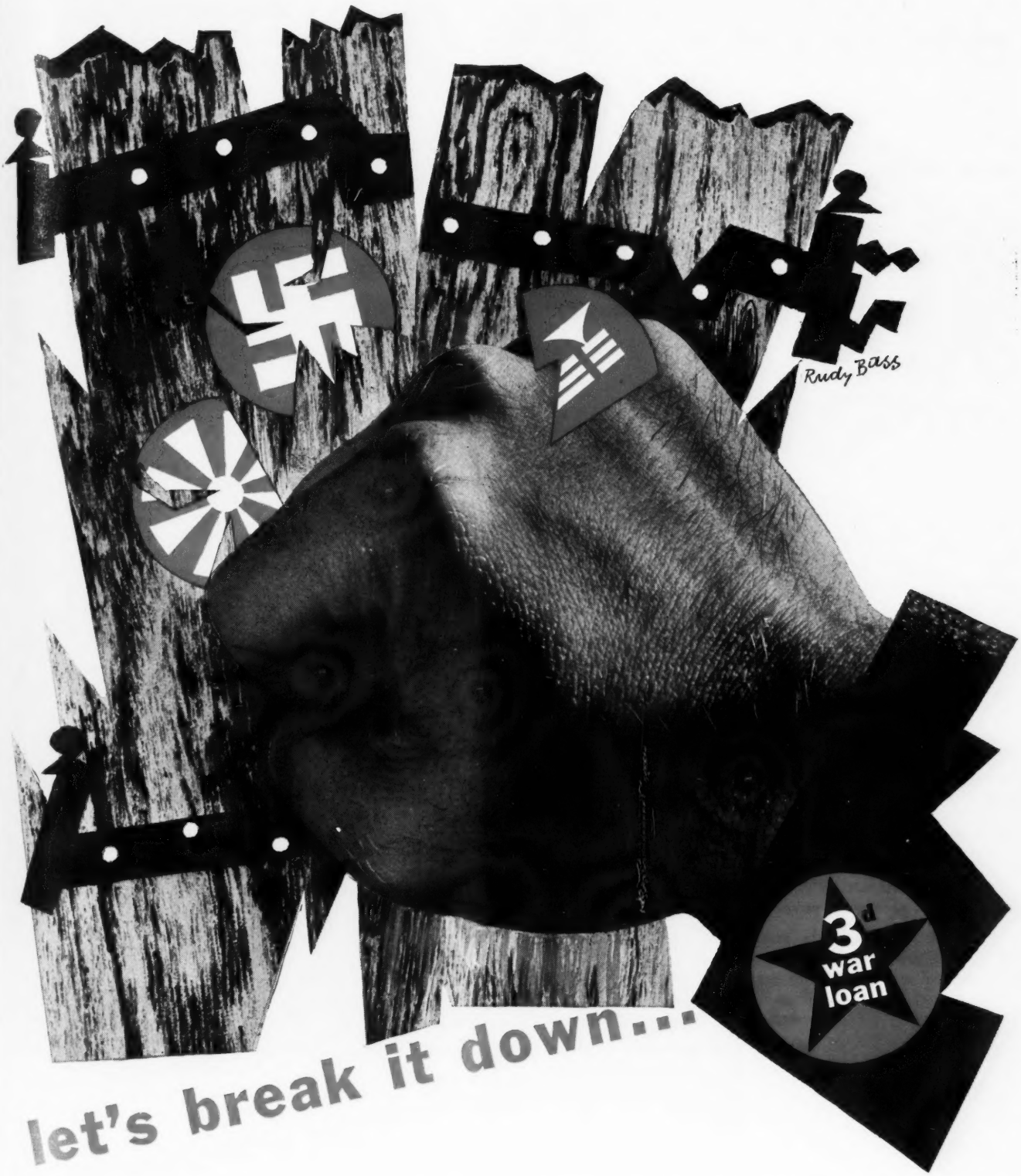
The word "National" and the three pyramids symbol are trade-marks of National Carbon Company, Inc.

CONSERVATION AND CARE WORK HAND IN HAND

In the present emergency it is particularly essential that your electrical equipment be kept running constantly and at full efficiency. Proper cleaning and elimination of minor faults will do much toward accomplishing this objective.

The Modern Pyramids Bulletins pictured above give practical suggestions on care and maintenance of brush-using electrical equipment. They are available to you without charge.

NATIONAL CARBON COMPANY, INC.
Unit of Union Carbide and Carbon Corporation
UCC
CARBON PRODUCTS DIVISION, CLEVELAND 1, OHIO
General Offices: 30 East 42nd St., New York, N. Y.
Branch Sales Offices: New York - Pittsburgh - Chicago - San Francisco



let's break it down...

We've only been knocking at that door . . . Midway . . . Guadalcanal, Attu, Buna, Munda . . . Tunisia, Pantelleria, Sicily. . . .

Magnificent actions all . . . but only steps that have brought us to the threshold of Victory.

Now it's here. *Invasion!*

But we've got to back these fighters with a fighting home front.

The 3rd War Loan Drive is on. The quota is $15,000,000,000.

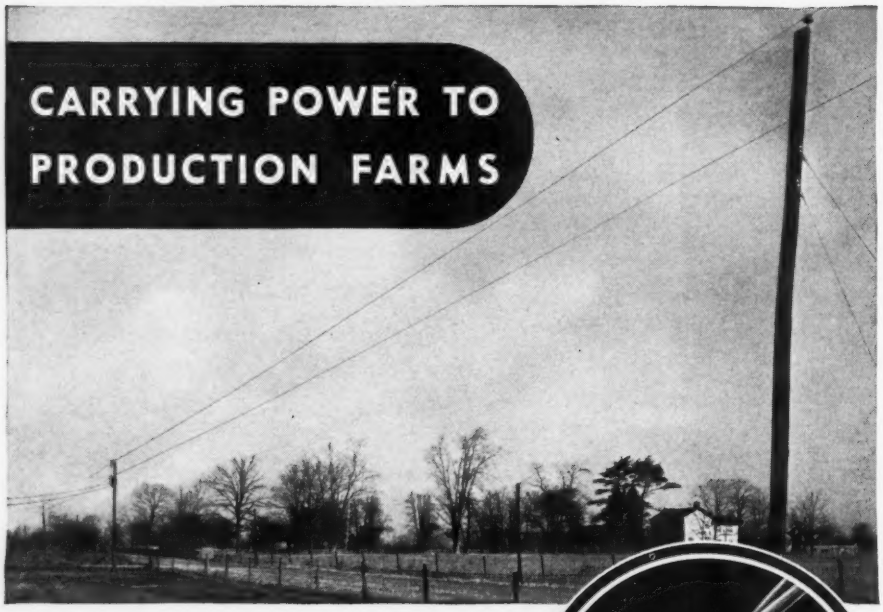
The United States Government is asking you to invest in at least an *extra* $100 bond during September. But the job doesn't end there. We've got to get our family, friends and fellow employees to invest in their share of these victory-producing bonds and back the attack that has brought us this far.

Remember, this is what we've been waiting for. This is *invasion!*

back the attack with war bonds!

The Okonite Company, Passaic, N. J.

manufacturers of insulated wires and cables since 1878



Crapo STEEL CONDUCTOR

THOUSANDS of the nation's food producing farms are being electrified during this critical period, thanks to Crapo Steel Conductor. This efficient conductor material—conceived during World War I, perfected and proved in on rural lines during the peace years—was ready to meet the needs of the current war emergency when these arose.

Crapo Steel Conductor, developed specifically for the overhead transmission and distribution of power, provides a combination of physical strength and electrical efficiency never before available in ferrous wire.

Its extra high tensile strength makes possible long spans with flat sags and greater ground clearances, reduces the number of pole structures required, saves critical man-hours and materials. Electrically, this conductor is unique because of its low 60-cycle resistance, low magnetic permeability and low 60-cycle reactance.

Write for New Engineering Manual

For rural extensions authorized by Utilities Order U-1-c, specify No. 6 B.W.G. Crapo HTC-130 Stranded (3-wire) Conductor—the size and type recommended for the purpose!

For information on other applications, contact the nearest office of the Graybar Electric Company Inc., Distributors! Or, write direct for the new engineering manual containing complete information about Crapo Steel Conductors!

INDIANA STEEL & WIRE COMPANY
Muncie . . . . Indiana

Crapo HTC-130 STEEL CONDUCTORS

LETTERS
to the editor

To the Editor:

Congratulations on the issue of August, 1943. We are all pleased with the story on the dimout award.

However, I think the article on small war plants is not complete, as the fountainhead and most active section of the newly reorganized set-up is right here in San Francisco. May I suggest that you call on Frank Smith, regional director, and I am sure that he will give you additional information that could be the basis for another interesting article.

R. E. FISHER,
Vice-president in charge of public relations and sales
Pacific Gas and Electric Co.
San Francisco, Calif.

To the Editor:

"The Old Soup" who wrote the letter to "Dear George" on page 51 of the August issue apparently was not familiar with the fact that patent anchors save a lot of time in installation and do a much better job than "concrete anchors, old engine flywheels, locally cast iron cones, and even the old treated wood slug."

We will be glad to send "The Old Soup" some information on this subject if you so desire.

H. A. HOUSTON,
Advertising Manager,
A. B. Chance Co.
Centralia, Mo.

To the Editor:

I am very much interested in the pictures on page 68 of your August issue, portraying a new and improved fly exterminator, but surely some one slipped up somewhere in labeling the thing "a fruit and vegetable dryer."

. . . is it not a mistake for ELECTRICAL WEST to publicize what looks as though it could not possibly be other than a thoroughly hazardous contraption, threatening both personal injury and the danger of fire? We are working particularly strenuously just now to secure the widespread adoption of the ordinance regulating the sale of unsafe electrical merchandise and appliances, stating to the city fathers whom we contact that the electrical industry is making an earnest effort to protect its customers against unwitting exposure to any electrical hazards.

This thing which you publicize to an extent which indicates endorsement has 203 ft. of exposed wire and operates under the humid conditions of dehydration. Sure, you say "the construction is not an underwriters' job and does contain hazards," but I do not feel that an admission of guilt exonerates the culprit. . . .

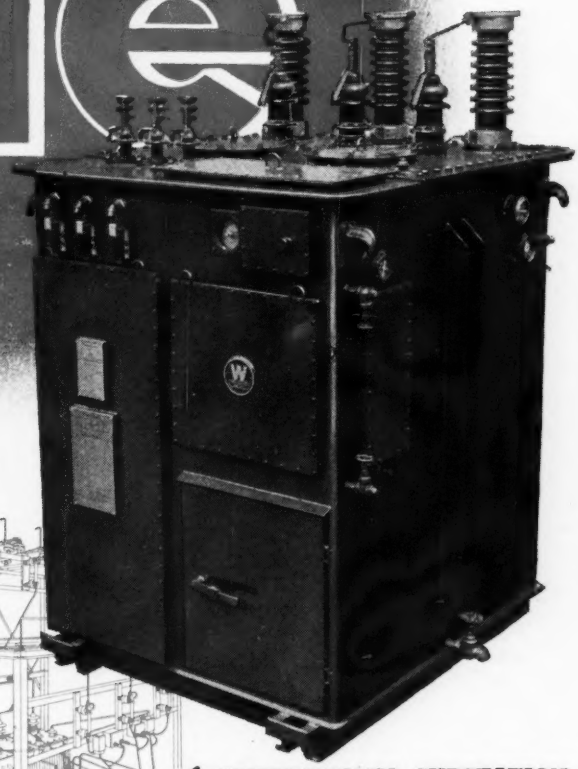
The principal point I want to make is that while we must of necessity make a number of concessions to the limitations on available materials and equipment during the war, I don't feel the industry is justified nor that the majority of the people in the industry desire to use the present situation as an excuse for destroying recognized safety standards.

VICTOR W. HARTLEY,
Managing Director,
PCEA.
Los Angeles, Calif.

(Continued on Page 12)

ONE UNIT · ONE ORDER · ONE SHIPMENT · ONE INSTALLATION

one



NEW LIGHT-DUTY CSP POWER TRANSFORMER REPLACES 43 SEPARATE PIECES OF EQUIPMENT

This complete factory-packaged substation is first choice for industrial service.

Its compactness and portability permit installation nearer the load center. This improves voltage regulation . . . and saves on copper runs.

The CSP Power Transformer performs all the functions of a conventional substation . . . it occupies less than one-third the space . . . and is better looking.

CSP (Completely Self-Protecting) means:

(1) Three-point protection against lightning.

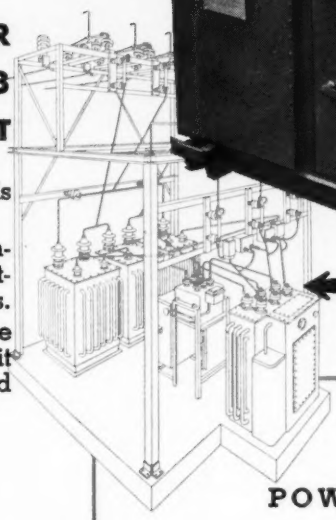
(2) Automatic protection against short circuits.

(3) Thermal protection against dangerous overloads. (Loading by Copper Temperature.)

All the thermal capacity of the transformer is made available, SAFELY . . . ideal for short-time overloads . . . conserves Critical Materials.

Ratings: 300—1000 kv-a; 50,000 kv-a breaker; 13,200—33,000 volts primary; 4160 volts secondary.

For complete information, call your Westinghouse Office or write for Descriptive Data 48-150, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-70402



CONVENTIONAL SUBSTATION—with 43 components, takes up more than three times the space required by the new CSP Power Transformer.

THE CSP LIGHT-DUTY POWER TRANSFORMER:

- Saves man-hours—simplifies ordering, installation and maintenance.
- Saves space—occupies less than one-third the space of a conventional substation.
- Saves materials—smaller and lighter than conventional substation. Hipersil* cores save electrical steel.
- Is completely protected against burnouts.
- Is completely protected against lightning.
- Is easily moved.

* Registered trade-mark, Westinghouse Electric & Manufacturing Co., for HIgh PERmeability SIIicon steel which carries ⅓ more flux.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

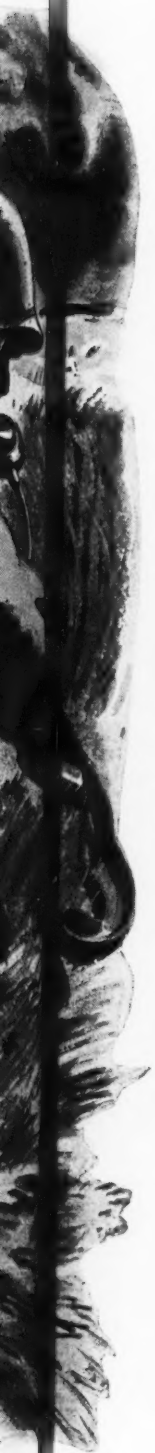
WHEN OUNCES FEEL LIKE POUNDS..A

*Reg. U. S. Pat. Office

1230 SIXTH AVENUE
ROCKEFELLER CENTER, NEW YORK 20

UNITED ST

...ASSAULT TROOPS USE LAYTEX*



You know how it is. You slog along all day under full equipment. At first you don't mind the weight very much. But as the hours crawl along, everything you're toting gets heavier and heavier. The canteen you didn't notice in the early stages now weighs as much as your rifle did then. And your rifle feels like a howitzer. Every ounce turns into a pound.

That's why . . . when you're moving fast and the going is tough . . . it's smart to use Laytex Assault Wire.

A full mile of Laytex Assault Wire weighs less than 30 pounds.

Laytex Assault Wire has a breaking strength of 50 pounds per conductor and a talking distance of more than 5 miles.

Laytex resists concussion and a wide range of temperature changes.

It is flexible and waterproof, strong and tough

Conductors are accurately centered and the weight of insulation and the diameter of the insulated conductor are kept at the minimum.

All this adds up to the fact that one man, wearing a breast reel of Laytex Assault Wire can move swiftly and easily. One man can maintain sure communication with operational headquarters.

Listen to the Philharmonic Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

...STATES RUBBER COMPANY

Back on the Job with KLEIN'S

Since 1857

MANY linemen—electricians—and other Klein users are today engaged in the important job of maintaining communications on our war fronts all over the world.

In the service of men at the front, Klein equipment is winning even higher esteem than ever before. For today, practically all of Klein's production goes to the Army, Navy, and to war workers.

When the war is won and these men return to American industry, they will find Klein pliers and wrenches, climbers and grips, safety straps and belts ready to serve them on their peacetime jobs.

The name "Klein" will continue to mean the highest in quality then as it has "since 1857."

Back home, one contribution we can make to speed Victory is the conservation of tools and equipment. To help in this important job, Klein has prepared an illustrated pocket manual on the care and correct use of tools to assure their long life. A copy will be sent to anyone interested.

ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York

Mathias KLEIN & Sons
Established 1857 Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO

To the Editor:

May I suggest that such questionable electrical devices as the home-made food dyer shown on page 68 of your recent (August) issue be carefully edited before going to press. This is indeed a very dangerous affair. . . .

W. W. CRANSTON,
Vice-president,
Thermador Electrical Mfg. Co.
Los Angeles, Calif.

To the Editor:

You will be interested to know that I received a letter from John Vrlak & Co. of Vancouver, B. C., in regard to the training article in ELECTRICAL WEST. They have much the same training problem we have at Moore's. I have had our training department write this concern giving full details of our training set-up and explaining just how it is handled. We are pleased to be able to help this shipbuilder and hope that our training course will aid them in solving their manpower problems.

H. S. DUSENBERY,
Moore Dry Dock Co.
San Francisco, Calif.

BOOKS *you may want*

MAGNETIC CIRCUITS AND TRANSFORMERS, by members of staff, Department of Electrical Engineering, Massachusetts Institute of Technology, first edition, 718 pages, with many illustrations; John Wiley and Sons, $6.50. The material contained within this book is divided into two parts. The first part is theoretical; that is, it describes the electro-magnetic theory, gives general properties of magnetic materials, and their uses, discusses electric and magnetic circuit analogies, shows methods of computing magnet circuits with long and short air gaps, magnetic flux saturation and leakage flux, the energy carried by a magnetic field.

Other chapters determine methods used for obtaining total core loss, values of exciting current, distortion of alternating voltages and current wave shape when materials are magnetized. A particularly valuable chapter is included which deals with thermal properties and heat flow through various materials; this subject is one of great interest to both the designing and application engineer.

The second part of the book covers equipment using magnetic circuits and fields, such as transformers, reactors, and regulators for both power and electronic apparatus.

The theory of designing such equipment is discussed and many examples are given. Included are chapters dealing with inductive coordination; efficiency and regulation of transformers; their circuit connections. Single and polyphase transformer arrangements are described.

This book gives many examples, completely solved, to show the methods of attacking magnetic circuit problems. Many other problems are given for those who wish to gain proficiency in solving them. The authors have included six pages of symbols and an extensive bibliography on this subject, making the book valuable to both students and engineers.—F.S.B.

LARGE BANKS OF CAPACITORS PROVIDE A QUICK, LOW-COST WAY OF RELEASING SYSTEM CAPACITY

QUICK: The *availability* of Pyranol capacitors as a source of reactive kva makes their use the quickest method of releasing system capacity for heavy war loads —especially now when materials, and labor to manufacture equipment, are at a premium.

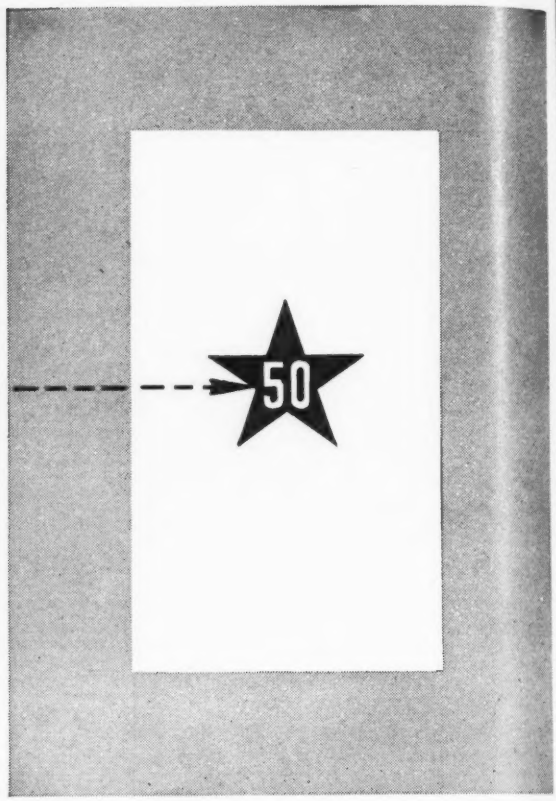
LOW COST: Pyranol capacitors can be put on a system at a cost of well under $10 per kva. The relatively high-cost system facilities can then deliver more kilowatts. This is of vital importance in the wartime drive to obtain maximum kilowatts from present facilities. Savings in critical materials, and ease of installation and switching to meet variable load demands, are also important considerations.

INSTALL THEM IN LARGE BANKS NEAR THE LOAD: Banks of G-E Pyranol capacitors are available as large outdoor and indoor rack-type equipments. Many utilities have found it advantageous to build their own outdoor racks of wood and standard-line hardware, so that they can use these capacitors in smaller groups on distribution circuits when the emergency need for larger banks is past.

Ask your G-E representative for his suggestions on the application of capacitors in large banks. He'll be glad to help you with such problems as fusing, relay protection, and switching. Or write for Catalog GEA-2764B. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

407-46-5700



an open letter to WIREMOLD men in the service...

Hartford, Connecticut

I cannot tell you how much personal satisfaction it gives me to report to you that your Company has been awarded the Army-Navy E for excellence in the production of the materials you need to fight with.

The men and women you worked with have earned this award by putting every ounce of their energy, and then some, into their particular jobs. Our part is a small one compared to the one all of you are playing, but in this man's war, every wheel must turn constantly and fast.

We can honestly say that one of the most important factors in spurring us on to the kind of effort we have achieved is our thoughts of those of you who have left to go into the armed forces. The work that has brought this Award is about the only way we have of telling you that we're in the outfield backing you up. You have our pledge that we will continue to do so.

Best of luck from all of us.

THE WIREMOLD COMPANY

D. Hayes Murphy
President

P.S. We are continually increasing our purchase of War Bonds, too.

WIREMOLD Makers of Textile Webbing and Metal Precision Parts for the Army and Navy.

EFFICIENT "WAR-TIME" LIGHTING with TRU-GLO'S New Fluorescent Fixtures

for INDIVIDUAL and CONTINUOUS Row Lighting

Tru-Glo fixtures are practical and economical to install and combine all the features of higher priced models. They comply with the latest W. P. B. requirements and are E.T.L. and Underwriters approved.

The reflectors are formed of Masonite in the design approved by the U. S. Bureau of Standards. Finished in certified hard oven-baked-on white enamel, a reflection factor of over 83% is attained. Outside finish is battleship gray baked enamel. Reflectors are held to body by wing nuts and are easily removed for cleaning.

The entire construction is sturdy; the wiring channel is simplified and finished inside and out with oven-baked-on battleship gray enamel. Starter seats are fastened to the body and are easily accessible—starters may be replaced without removal of lamps or reflectors.

Each unit is complete and may be used singly or for continuous runs— knock-outs in housing ends permit locking together any number of units. Knock-outs in top of housing are provided for conduit suspension. Hanger brackets permit chain suspension.

Though we have used a minimum amount of war materials, all parts are E.T.L. certified. Ballasts are high-power factor.

Write or wire for our latest catalog giving further information, and for the name of your nearest distributor.

THE TRU-AD CO. Est. 1928
1019-25 N. MADISON AVE.
LOS ANGELES 27, CALIFORNIA

FACTS *you should know about* SPECTRUM SERVICE

WHAT IT IS . . .

Electricity operates in some form or other over the entire frequency range of the Electromagnetic Spectrum and requires equipment in various forms. Spectrum Service indicates a source of supply wherein complete electric and electronic supplies are available for use throughout the full Electromagnetic Spectrum.

WHAT IT MEANS TO YOU

Spectrum Service means you can spend less time locating various types of electric and electronic supplies and equipment. You need not waste time calling a number of suppliers — your requirements can now be filled through *one* source. ONE-STOP Spectrum Service can save your time just as your wife's One-Stop grocery shopping has saved her time.

Your Time is VITAL Save it . . . CALL MEYBERG FIRST!

To illustrate:

Below, are indicated the segments of the ELECTROMAGNETIC SPECTRUM with just a few of the countless products available from stock to meet your requirements.

POWER AND LIGHT

Wiring Devices, Conduit and Fittings, Wire and Cable, Cabinets, Motor Control Apparatus, Gutters, Fans and Blowers, Fixtures, Fuses, Heating Devices, Insulating Materials, Lamps, Lugs, Connectors, Marine Fittings, Motors and Generators, Convertors, Porcelain, Pot Heads, Pole Line Equipment, Signalling Devices, Staples, Switches, Relays, Tape, Tools, Transformers, and hundreds of Electrical items and parts.

AUDIO FREQUENCIES

Commercial and Industrial Sound Systems (Fully Engineered) and parts.

INDUCTION HEATING

Control Apparatus, Industrial Heating Units (Engineered).

RADIO

Chokes, Receivers, Centralstation Equipment, Mobile Equipment, Vibrators, Condensers, Tubes, Jacks, Connectors, Microphones, Dials, Headsets, Sockets, Switches, and hundreds of parts too numerous to list. Photoelectric Control Equipment, Replacement parts and Fully Engineered Systems.

INFRA RED

Fostoria Equipment and Parts for Industrial: Baking, Drying, Dehydrating, Preheating.
Pest Control.

VISIBLE LIGHT

Mazda Lamps, Fluorescent and Incandescent Fixtures, Spot and Flood Lighting, Industrial and Commercial Light Engineering.

ULTRA VIOLET

"Sun" Lamps, Germicidal Lamps, Diathermy Equipment and Parts.

X-RAYS, GAMMA RAYS, & SECONDARY COSMIC RAYS

Types of Associated Electronic Equipment: Resistors, Vacuum Tubes, Photo Tubes, Pliotron-Electrometer Tubes, Phanotrons (Gas Rectifier) Tubes, Ignitrons, Thyratrons, Radio Transmitting Tubes, Radio Receiving Tubes, Transformers, Volt Adjustors, Capacitors, Test Equipment Cathode Ray Oscillo Graph, Test Oscillators.

ALL THE LEADING LINES

INDUSTRIAL ELECTRIC and ELECTRONIC SUPPLIES

LEO J. MEYBERG CO.

INCORPORATED

70 TENTH ST. SAN FRANCISCO, 3
TELEPHONE UN 1212

2027 S. FIGUEROA ST. LOS ANGELES, 7
TELEPHONE PR 6011

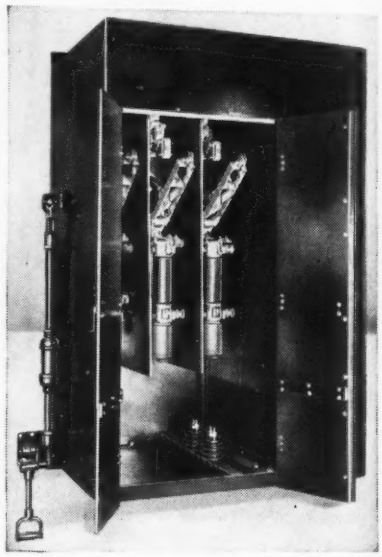
MOST COMPREHENSIVE STOCKS WEST OF CHICAGO

PRODUCTS *that are news*

Switching Assemblies (900)

Schweitzer & Conrad, Inc. has announced a line of switching and short circuit protection assemblies combining load switching of high voltage circuits with short circuit protection. It is claimed that the load interrupter switch will interrupt loads up to 400 amp. at 15,000 volts without drawing an arc across the main switch contacts.

According to the manufacturer, these assemblies are designed for installation at substations, main and branch feeders, and



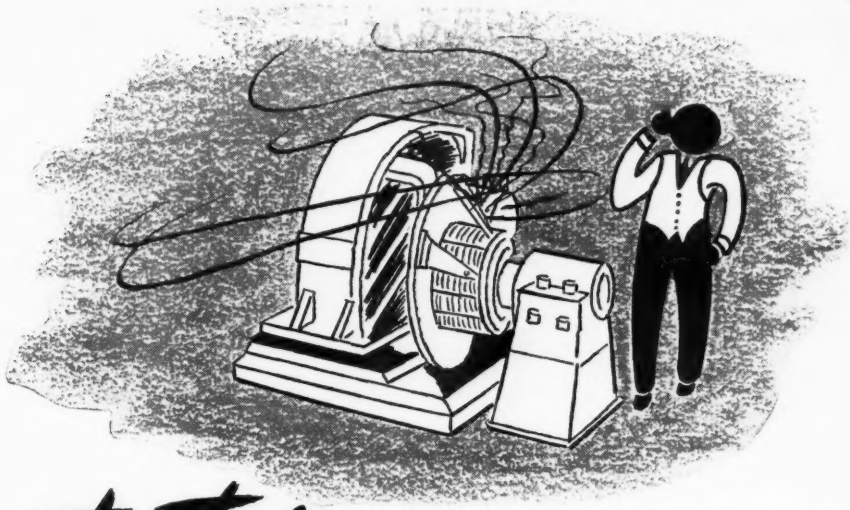
for use as throw-over devices from two alternate feeders or power sources and for many services where all the functions of circuit breakers are not essential. The heavy duty fuses have short circuit interrupting ratings of 20 000 rms. amp. at 13,200 volts; 25,000 at 6,600 volts; and 30,000 at 2,300/4,000 volts.

Circuit Tester (901)

Communications Measurements Laboratory has designed an automatic high-speed mass production tester, which it claims practically eliminates the human element and makes possible accurate tests by unskilled personnel. According to the manufacturer, by use of this device, Wheatstone bridge precision can be attained while testing circuits at the rate of one per second. Also available from this manufacturer is a model for aircraft and other multi-wire testing.

Pumping Motors (902)

General Electric is offering a new line of vertical high-speed hollow-shaft synchronous motors which it recommends for pumping applications where a large volume of fluid is handled. These motors are available in ratings from 100 to 1,000 hp.; and in speeds from 514 to 1,800 rpm., have a drip-proof enclosure; can be furnished with non-reverse ratchets to prevent reversal of pump rotation at shutdown or on starting. Frames are of cast-iron construction.



Commutator GROUNDED AT 6 P.M.

BACK ON THE JOB AT 8 A.M.

150 KW D-C GENERATOR OUT OF SERVICE AT 6:00 P.M.

ARMATURE RUSHED TO WESTINGHOUSE DISTRICT MANUFACTURING AND REPAIR PLANT. COMMUTATOR DISMANTLED, FRONT V-RING REMOVED, NEW SECTION OF MICA V-RING INSTALLED. COMMUTATOR REASSEMBLED, TESTED, TURNED AND UNDERCUT. GENERATOR READY TO OPERATE AT 8:00 A.M.

Westinghouse

DISTRICT MANUFACTURING AND REPAIR

J-94540-A

IF **THE EQUIPMENT NEEDING REPAIR IS VITAL TO THE WAR EFFORT . . . PHONE THE NEAREST OFFICE OF WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY FOR**

EMERGENCY SERVICE

33 M & R PLANTS . . . ONE NEAR YOU!

LOOK WHAT'S HAPPENED TO

SINCE G-E MADE THIS ANNOUNCEMENT

FACTS YOU SHOULD KNOW ABOUT NON-METALLIC REFLECTORS for Fluorescent Fixtures!

EFFICIENT NEW REFLECTORS RELEASE TONS OF STEEL FOR OTHER WAR PRODUCTION

INTENSIVE work by the lighting industry now has developed non-metallic reflectors for fluorescent lamp fixtures. They are efficient, light in weight and built to stand up under hard usage in industry.

No more steel reflectors may be manufactured except for dust-tight and vapor-proof units. Realizing the need to conserve metal, lighting engineers have been working for almost a year to find alternate reflector materials. They have succeeded. General Electric is proud to have been able to contribute to the research that has made these efficient new reflectors possible.

There have been, of course, many experiments with non-metallic reflectors. To make certain that the reflectors on the fixtures you get will give uniformly satisfactory service . . . that they will be strong and durable . . . you will find it advisable to buy tested and certified fixtures. Look for the Fleur-O-Lier or RLM label!

General Electric ran this announcement in electrical magazines in January 1943, showing sample fluorescent fixtures made to comply with WPB restrictions on metals.

FLEUR-O-LIER
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
ELECTRICAL TESTING LABORATORIES
NEW YORK, N. Y.

Fluorescent fixtures bearing either of these two labels are made to rigid specifications for mechanical, electrical, and illuminating excellence; and are tested and certified by impartial experts, Electrical Testing Laboratories, Inc. of New York. You can depend on fixtures bearing these labels.

Hear the General Electric radio programs: "The Hour of Charm", Sunday, 10:00 p.m., E.W.T., NBC; "The World Today" News, each weekday, 6:45 p.m. E.W.T., CBS.

BUY WAR BONDS!

G-E MAZDA LAMPS

GENERAL ELECTRIC

FLUORESCENT LIGHTING . . .

RESTRICTIONS which WPB has established on the use of metals in fluorescent fixtures have been a challenge to the lighting industry. A challenge which the industry was more than ready to meet, but which presented almost insurmountable difficulties—coming as it did along with an acute shortage of lighting equipment for important war plants.

Long before the first WPB order, General Electric engineers had been working with fixture manufacturers to develop new fixtures using a minimum of critical materials. Last January, G-E announced that several types of non-metallic reflectors had been developed. Today, thanks to the ingenuity of the fixture manufacturers, a large selection of certified fluorescent fixtures, complying with WPB requirements and meeting the lighting industry's rigid specifications, are now available on priorities for war plants that need them.

General Electric is proud of its share in this achievement—and G-E research will continue to work with fixture manufacturers toward making better and better lighting fixtures—for the duration and afterwards.

Now... CERTIFIED FIXTURES ARE AVAILABLE FROM MANY MANUFACTURERS

LIGHT—STURDY CONSTRUCTION . . . FOR CONTINUOUS ROW OR INDIVIDUAL MOUNTING . . . 2 OR 3-LAMP TYPES IN 40-WATT SIZE—2-LAMP 100-WATT SIZE

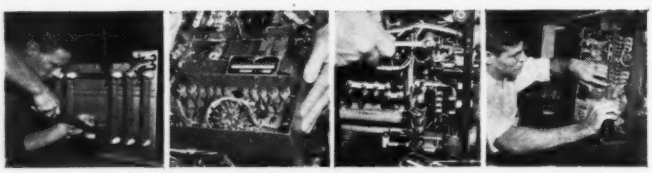
Here are a few of the many different types of certified fluorescent fixtures available from the 50 Fleur-O-Lier and RLM Manufacturers through their wholesalers. All comply with WPB conservation orders and are made by manufacturers of ETL certified equipment. (*Names of these manufacturers on request.*)

General Electric does not make lighting fixtures but is glad to recommend certified fluorescent fixtures.

**In process of certification when this advertisement goes to press.*

G-E MAZDA LAMPS

GENERAL ELECTRIC



The Ward Leonard, Vitreous Enamel, Wire Wound Resistors shown are used on maintenance and operation equipment at the Miami Clipper base of Pan American World Airways.

ARMY E NAVY ARMY E NAVY

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control (WL) *devices since 1892.*

WARD LEONARD ELECTRIC COMPANY, 68 South St., Mount Vernon, N. Y.

VICTOR INSULATORS INC

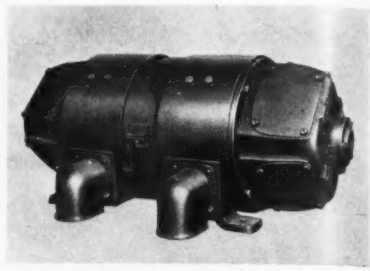
VICTOR, NEW YORK

Distributed by **MAYDWELL & HARTZELL,** *Incorporated*

SAN FRANCISCO LOS ANGELES SEATTLE

Motor-Alternator (903)

Designed for converting d-c to a-c, a line of two-bearing, 3,600 rpm. motor-alternator sets in integral ratings up to 5 kva., single phase, has been announced by General Electric Co. In operation, the d-c motor of the set drives the alternator, which has a field



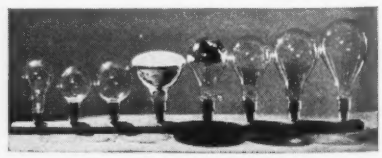
connected in series with the motor armature. An increase in the alternator load causes an increase in the motor load so that increased d-c is drawn from the line. This greater d-c current strengthens the alternator series field, tending to maintain a constant a-c voltage, the manufacturer states.

F Fixture (904)

The Edwin F. Guth Co. has announced a new wartime industrial lighting unit, which it states has been designed to compensate for WPB steel limitations. A die-formed one-piece full channel with metal "bends" is said to provide greater channel strength on the horizontal and the torque. This unit is available in sizes for two 40-watt, three 40-watt and two 100-watt fluorescent lamps.

Drying Lamps (905)

North American Electric Lamp Co. is offering a line of carbon filament lamps for infrared ray drying, baking and dehydrating. Included are inside-silvered self-reflector and the bull's eye silver type for diffusion and concentration of the ray.

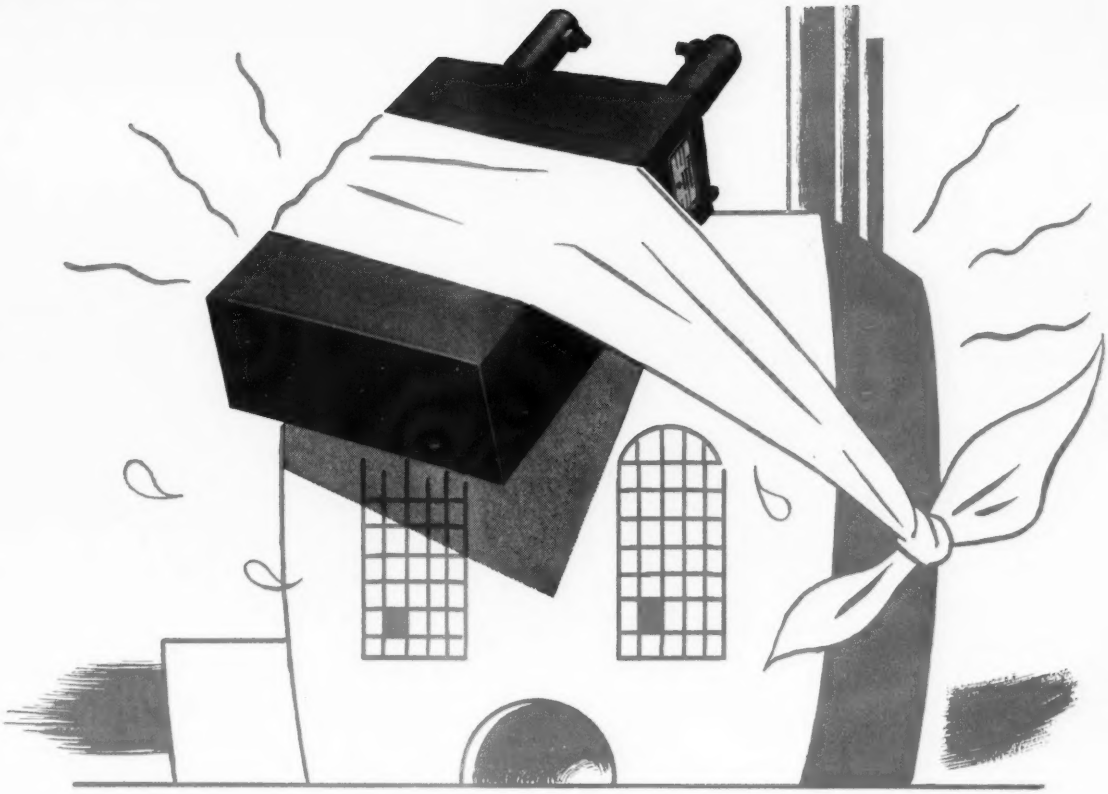


D-C Motors (906)

Direct-current vertical motors ranging from 40 to 200 hp. at 1,750 rpm. and in equivalent ratings at other speeds have been designed by General Electric Co. for low-thrust, solid-shaft applications on pumps, machine tools and marine underdeck auxiliaries. According to the manufacturer, they are desirable where floor space must be saved or the expense of gearing avoided.

Fluorescent Unit (907)

A new fluorescent unit with a device for facilitating release and replacement of the reflector is being manufactured by the A. L. Smith Iron Co. Wing nuts for releasing the reflector carry captive hood bolts which slide in and out of a pair of coves which are part of two cross bridges welded to the housing.

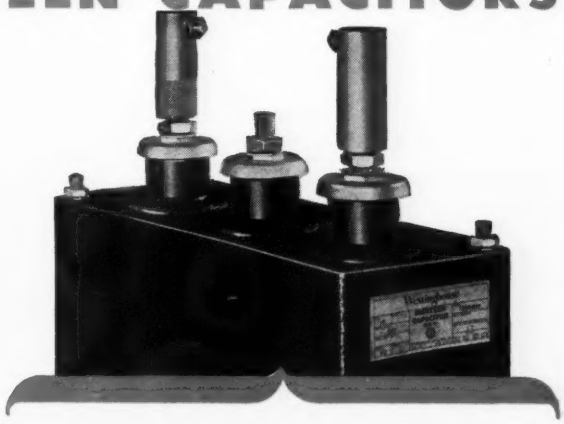


QUICK RELIEF for overloaded systems... with Westinghouse INERTEEN CAPACITORS

Relief for overloaded systems doesn't necessarily call for more lines and equipment. Where part of the overloaded condition is due to low power factor caused by inductive loads, the cure is quick and simple—Westinghouse Inerteen Capacitors.

By improving power factor, Inerteen Capacitors relieve lines and equipment of "dead-head" current, and quickly release capacity for useful power. All-around system performance is measurably improved. Installation is simply a matter of installing capacitors at the substation or on the distribution circuits.

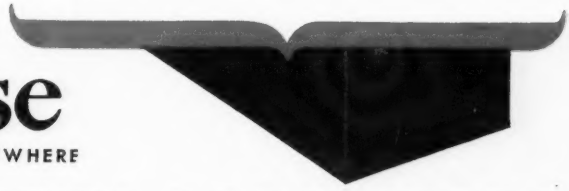
To relieve feeder problems, and wherever industrial customers have a heavy inductive load that is taxing present lines and equipment, recommend Westinghouse Inerteen Capacitors. For more information, call your nearest Westinghouse Office or write Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N. J-60534



ONE-THIRD TO ⅔ KV-A OF LOAD-CARRYING CAPACITY IS RELEASED BY EACH CAPACITOR KV-A INSTALLED

★ ★ ★

FOR EXAMPLE: One utility provided 6,000 additional kv-a of power for a new tank plant by installing 15,000 kv-a of capacitors.



Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

INERTEEN CAPACITORS

Hotpoint's Bond Waqon D
Another Hot Campaign

Start the 3rd WAR LOAN right

Get on the Bond Wagon now

The tempo of the war steps up on world battlefronts. The obligations of those of us on the home front increase. Hotpoint's War Bond Campaign for fall follows the pattern which has won so much acclaim from government officials and building industry alike. This fall program cooperates with the Government in reaching its *3rd War Loan* objective—inducing larger numbers of wage earners to buy more and *still more* War Bonds.

Thomas H. Lane, Chief, Advertising Section, Treasury Department, Washington, says: "We will certainly appreciate anything you can do in connection with the *3rd War Loan* and I hope you will send me proofs of your fall advertising when they are ready. Many thanks again for the grand job you and your company are doing on behalf of the Treasury."

Here's how you can help. You can support Hotpoint's Bond Wagon Campaign with your newspaper advertising, and in your sales contacts. Newspaper mats are available.

Hotpoint has a complete Bond Wagon Plan for the building industry. Now is the time to get in contact with builders in your territory to pre-sell electric homes for the postwar era. Your Hotpoint distributor has this Plan.

Edison General Electric Appliance Company, Inc.
5612 West Taylor Street, Chicago 44, Illinois

Wartime Canning Book a Big Favorite

Hotpoint's Wartime Home Canning Book has been acclaimed an important contribution to Victory Gardeners. Thousands have been bought by utility companies and retailers for distribution to their customers. With the fall canning season approaching its height now is the time to place your order with your Hotpoint distributor.

FOR OUTSTANDING ACHIEVEMENT IN WAR PRODUCTION

ELECTRIC Hotpoint KITCHENS

REFRIGERATORS • RANGES • WATER HEATERS • WASHERS AND IRONERS • CLOTHES DRYERS • AUTOMATIC DISHWASHERS • ELECTRASINK • STEEL CABINETS

Drive Rolls Into

We're Paving the ROAD TO VICTORY!

BY getting all the War Bonds we can possibly afford we're helping to bring the great day of peace nearer. The War Bonds which pave the Victory road today will lead to a truly modern home tomorrow. Our War Bond savings will provide the means for a new Hotpoint Electric Kitchen when the war ends.

Our War Bond Savings Will Buy a Hotpoint Electric Kitchen

FOR HOMES COSTING $6,000.

The Meadow Lark Kitchen illustrated is designed for homes costing as little as $6,000 and is completely electric, with Hotpoint Range, Refrigerator, Dishwasher, Sink and Hotpoint Steel Cabinets.

FOR HOMES COSTING AS LITTLE AS $4,000

Hotpoint Electric Kitchens including Range, Refrigerator, Sink and Steel Cabinets have been installed in numerous homes costing only $4,000.

THE FIRST STEP IN HOME MODERNIZATION

YOU can change or beautify your home any way you wish—but it won't be a real postwar job of remodeling until you've installed a modern electric kitchen. That's why so many families are earmarking their War Bond Savings for a new Hotpoint Electric Kitchen. Profiting by the discoveries and improvements of wartime production, our engineers will be able to build even thriftier, more efficient equipment after Victory. Start your modernization program today by sending the coupon below.

BUY WAR BONDS TODAY—an Electric Kitchen Tomorrow!

HOME PLANNING FILE

Start your plans ...

HOTPOINT'S NATIONAL ADVERTISING FOR FALL AND WINTER, 1943

PUBLICATION	ISSUE
Bride's	August 15
Successful Farming	September
House Beautiful	September
House Beautiful Maintenance and Building Manual	September
Better Homes and Gardens	September
Collier's	September 4
Electricity on the Farm	September
American Home	October
McCall's	October
Electricity on the Farm	October
Saturday Evening Post	October 9
Successful Farming	November
House Beautiful	November
House Beautiful's Guide for the Bride	November
Electricity on the Farm	November
Better Homes and Gardens	December
American Home	December
Collier's	December 11
McCall's	December
Saturday Evening Post	December 11

TOTAL ADVERTISING MESSAGES 33,216,000

'll be able to save time and by buying perishable foods antities. And foods stay longer in the Hotpoint Refrigerator.

● Two of your most tedious tasks will be gone with a Hotpoint Automatic Electric Dishwasher to do your dishes —a Hotpoint Disposall to get rid of food waste before it becomes garbage.

Kitchen Averages About 10% of Home-Building Costs

Hotpoint ELECTRIC KITCHENS

Above is the first in Hotpoint's fall series of full-color advertisements in National Magazines.

SCRAP IS POWER

Cooperate with your in try! Salvage all inopera parts containing critical terial. Put vitally-needed s back into the scrap TOD

A few of the many G-E fittings available

High Quality

ELECTRICAL FITTINGS

For Wartime Wiring

All of the electrical fittings needed on wartime wiring jobs can be found in the high quality General Electric line.* There are over 450 different items available—all of them particularly suited for today's needs.

For instance, there are fittings for BraidX, the non-metallic sheathed cable being used in factories and in war housing; there are connectors for factory bus drop cable; there are fittings for use with service entrance cable; and there are fittings for basket weave shielded cables and other cables. There are fittings for all raceways such as rigid conduit, thin-wall conduit, etc.

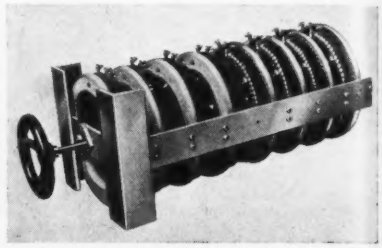
For further information, see the nearest G-E Merchandise Distributor or write to Section C931-18, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

*In keeping with WPB cadmium limitations, G-E fittings have bonderized non-metallic finish

GENERAL ELECTRIC

Tandem Rheostat Assembly (908)

Ohmite Mfg. Co. offers a tandem unit consisting of eight 1,000-watt, 12 in. diameter rheostats mounted in a steel frame and controlled by a single hand wheel. According to the manufacturer, other tandem assemblies can be made up of two, three or more rheostats ranging in power rating from 25 to 1,000 watts and in diameter from 1-9/16 to 12 in.



Marine F Fixture (909)

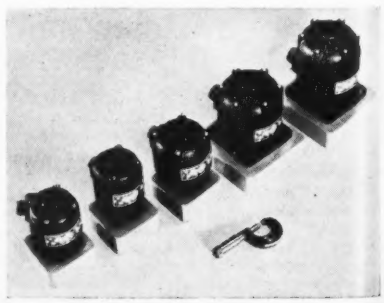
A fluorescent lighting fixture has been designed by Curtis Lighting, Inc. for marine use or for industrial plants where resistance to shock, vibration and oscillation must be taken into consideration. This unit takes two 15-watt fluorescent lamps. The tulamp ballast, lampholders, starter sockets and special terminal block can be removed from the housing as a complete unit, without dismounting the fixture from the ceiling or from the mounting brackets, it is stated. A Louverplas shield gives diffused illumination with lamp concealment.

Portable Lighting Unit (910)

A fluorescent unit designed to provide "extra" light for close and critical seeing tasks has been announced by the Mitchell Mfg. Co. A portable unit, the light can be hung up and plugged in where needed, the manufacturer states. A six foot cord and plug are provided. This unit uses two 20-watt fluorescent lamps; operates on 110-125 volts, 60 cycles a-c; is 4½ in. high, 24 in. long, 9½ in. wide.

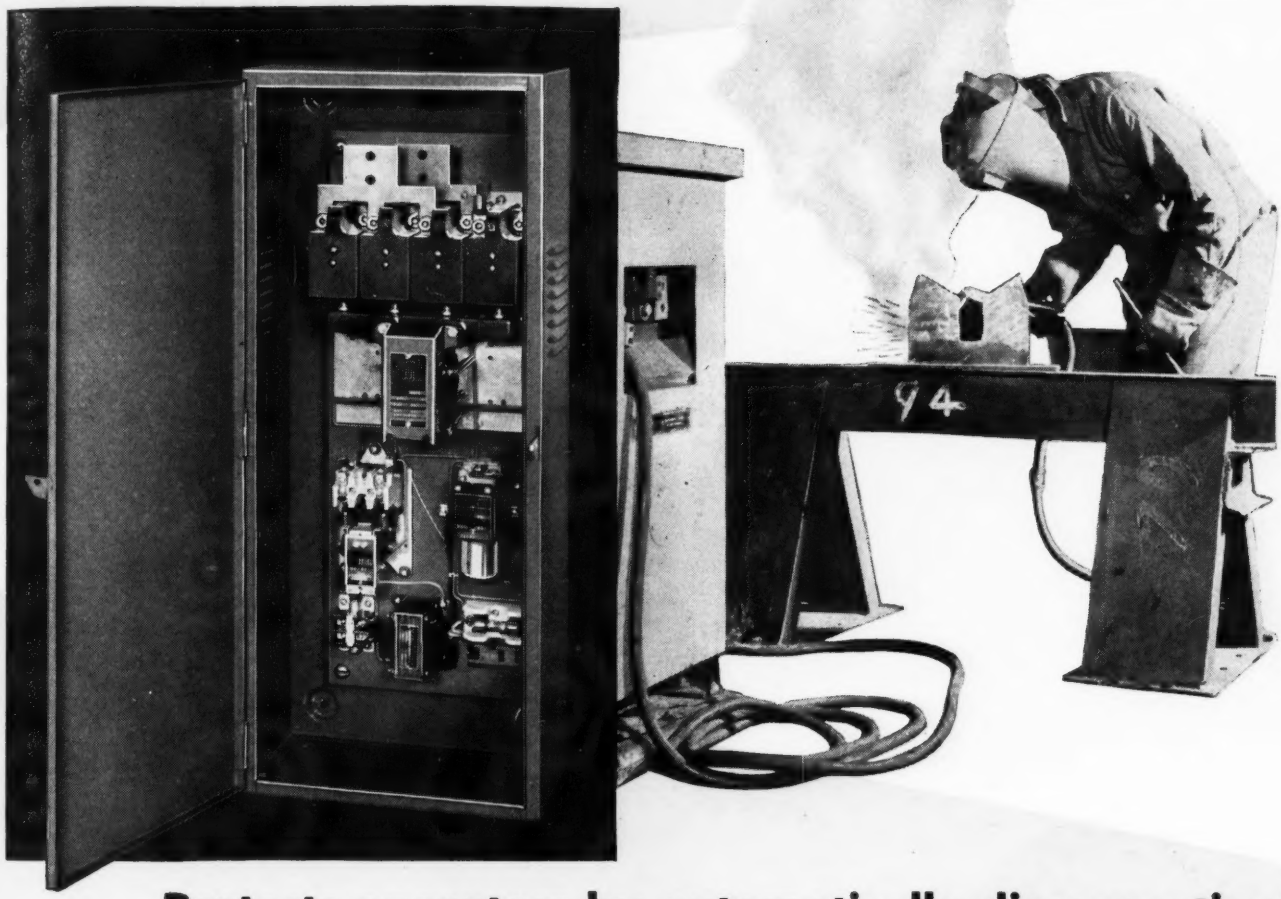
Aircraft Motors (911)

U. S. Electrical Motors, Inc. has developed a line of high frequency a-c electric motors for aircraft use. These motors operate on three-phase a-c 400 cycles and range from ⅛ to 15 hp. Synchronous speeds of



6,000 to 8,000 and 12,000 rpm. can be provided and lower speeds are available by means of integral type gear reducers, the manufacturer states. Supplied with various types of flanges for mounting on pumps, blowers, actuators and other equipment.

SQUARE D *Announces*
SAFETY CONTROL FOR A·C· ARC WELDERS



Protects operators by automatically disconnecting welding transformer when arc is broken . . . .

HIGH open circuit voltages of A. C. arc welders (transformer type) create a definite hazard to operators. Physical contact from electrode to grounded metal surfaces (when not welding) is sometimes serious.

Square D's new class 8992 safety panels eliminate this hazard by automatically disconnecting the welder transformer after the arc is broken. The transformer is automatically reconnected the instant the operator touches the electrode to the work. Thus, the arc is struck with no delay. There is no loss in operating speed or efficiency.

There is an economy angle, too. When Square D safety panels are used, the welding transformer primary circuit is connected to the power line only while the arc is held. Substantial saving in power is effected when a number of welders are used on a single power system and the power factor is improved.

These new safety panels can be used with any make or model of A. C. transformer type arc welder. External connections are simple and internal connections of the welder need not be disturbed.

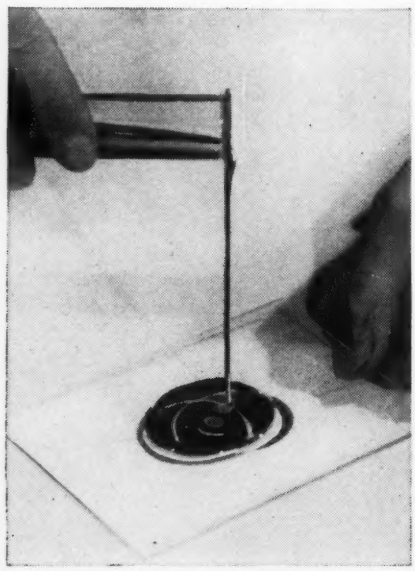
ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

LOS ANGELES • DETROIT • MILWAUKEE

CARBON? IT'S NO PROBLEM NOW

1. It's a fact that practically all carbon deposits are caused by motor oil. And it's carbon that makes motors knock, waste gas, and grow old before their time. So, when you put two and two together, the wise thing to do is buy a lubricant that forms a *minimum* of carbon. Right?



2. Well, that's precisely why so many truck owners are switching to Unacal Truck-Bus Motor Oil. This lubricant forms less carbon than most other oils for one simple reason—*it contains a minimum of the elements that cause carbon!* It's Propane-Solvent refined, a 100% pure paraffin-base oil!

3. There are other reasons, also, for Unacal Truck-Bus Motor Oil's popularity today. It's a *balanced* lubricant. It does all the jobs you want it to do—*and does them right!* It is unusually stable, stands up under a heavy pounding. It has a low wear factor, keeps motor wear *down*.

4. So while you're thinking about it, call your Union Oil Resident Manager for a supply of Unacal Truck-Bus Motor Oil. He will see that you get prompt delivery and friendly, courteous service.

TAKE THIS TIP! When you buy petroleum products buy enough to last. It will protect you against transportation tie-ups and will insure you of an adequate supply of the products you need.

UNION OIL COMPANY

OIL IS AMMUNITION—USE IT WISELY!

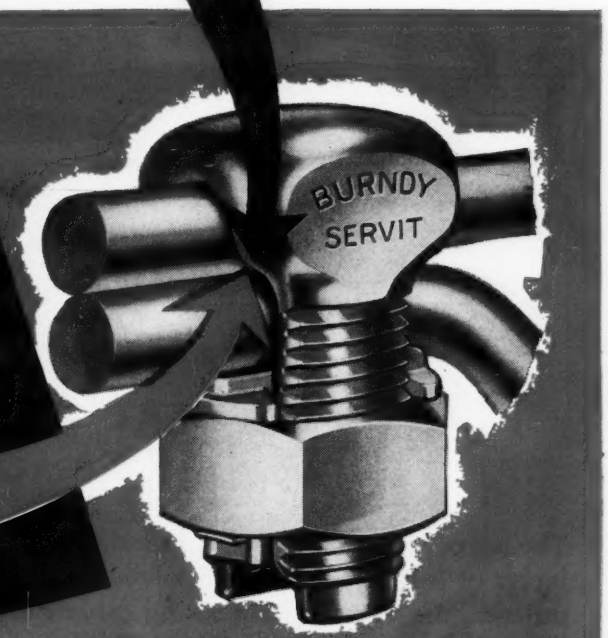
Keeps a firm grip on popularity

because of its *firmer grip* on the conductors!

The Burndy

SERVIT

...gives 50% greater contact pressure here



Pat. No. 20,096

Write for this new illustrated Burndy HYLINE catalog, illustrating the complete line of Burndy indent type connectors . . . including terminals, end-to-end, and separable connectors in all types and for all wire sizes from No. 29 up.

Its broad range of usefulness alone, would put the SERVIT *first* in popularity. But it *keeps* its firm grip on that position because of its *firmer grip* on the conductors... providing over 50% greater contact pressure between them.

This *extra* contact pressure results from the use of special high-strength alloys which enable the SERVIT to develop and maintain these high pressures indefinitely. Thus the SERVIT can be used over and over again.

SERVITS are available for conductors from No. 10 wire to 1000 mcm cable... with each SERVIT size accommodating a wide range of conductor sizes. Write for illustrated literature.

BURNDY ENGINEERING COMPANY, INC. 107 EASTERN BLVD., NEW YORK 54, N. Y.

BURNDY electrical connectors

A BETTER WAY

TO

- MAKE OIL-TIGHT STOP JOINTS
- SEAL SPLICES AGAINST MOISTURE
- MAKE OIL-TIGHT TERMINALS

The use of Harvel Oil Stop as a binder between layers of insulating tape has solved, for many utilities, the problem of making cable splices oil-tight and moisture-proof. This method effectively seals splices, stop joints and terminals—keeps oil in and water out—prevents insulation failure and loss of power. Cable splices and stop joints made with Harvel Oil Stop show no signs of failure after 6 years of service. Cable terminals treated with Oil Stop 9 years ago are still operating successfully. In many cases, use of Harvel Oil Stop eliminates the need for a barrier-type stop joint—in others, it saves the cost of a pothead.

CHECK THESE FEATURES AGAINST YOUR REQUIREMENTS

Oil Stop is a phenol-formaldehyde resin which, applied as a liquid, polymerizes quickly into a firm, enduring, infusible insulation at ordinary room temperatures. It will adhere satisfactorily to rubber, oil-impregnated paper, fibre, Bakelite and copper.

Oil Stop is non-inflammable, will not melt or soften after setting, and is not affected by acid and alkali solutions. Its electrical properties of dielectric strength, dielectric constant and power factor are extremely favorable.

Oil Stop, in addition to being oil-proof, moisture and weather proof, is non-corrosive. It has found a wide variety of applications underground and in the electrical industry generally for cable splicing, making oil-tight terminals, and stop joints.

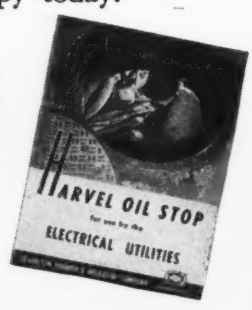
Send for new Harvel Oil Stop Manual containing step-by-step application details, test data, and interesting users' "experience reports". It is generously illustrated and full of practical suggestions on the many uses of Oil Stop. Write for your copy today.

Irvington

STANDARD OF THE WORLD
IRVINGTON INSULATION
TRADE REG. U. S. PAT. OFF. MARK

VARNISH & INSULATOR CO.
IRVINGTON, N. J., U. S. A.
PLANTS AT: IRVINGTON, N. J. & HAMILTON, ONT., CAN.
Representatives in 20 Principal Cities

West Coast Representatives: C. D. La Moree, 1325 San Julian St., Los Angeles, and 1889 Mission St., San Francisco, Calif.; Richardson Electric Supply Co., 166 Jackson St., Seattle, Wash.



BLAW-KNOX *Electroforged* GRATING

SAFE: twisted bar does the trick STRONG: one piece electroforged CLEAN: no sharp angles to clog

EASY TO PAINT · OPEN FOR LIGHT AND AIR

Whatever your grating needs—here's how to select the proper size.

WHAT TO SPECIFY WHEN ORDERING BLAW-KNOX ELECTROFORGED GRATING

- Size of bars and type.
- Painted or galvanized.
- Dimensions of area to be covered.
- Direction bearing bars are to run.
- Is clearance to be allowed.

BLAW-KNOX ELECTROFORGED STAIR TREADS

These treads are designed for the development of unusual strength against impact. Standard sizes and specifications follow:

Abrasive Width	Diamond Plate Width	TYPE "J" — 1" x 3/16" BARS Min. Length	Suggested Max. Length	A
6¾"	6 3/16"	1'6"	3'0"	2½"
7 11/16"	7¼"	1'6"	3'0"	4½"
9⅛"	8 3/16"	1'6"	3'6"	4½"
10 1/16"	9⅝"	1'6"	3'6"	7"
11½"	10 13/16"	1'6"	3'6"	7"

Abrasive Width	Diamond Plate Width	TYPE "L" — 1¼" x 3/16" BARS Min. Length	Suggested Max. Length	A
7 11/16"	7¼"	2'0"	4'0"	4½"
9⅛"	8 3/16"	2'0"	4'0"	4½"
10 1/16"	9⅝"	2'0"	4'0"	7"
11½"	10 13/16"	2'0"	4'6"	7"
12 11/16"	12"	2'0"	4'6"	7"

BLAW-KNOX DIVISION
OF BLAW-KNOX CO.
2072 FARMERS BANK BUILDING PITTSBURGH, PA.

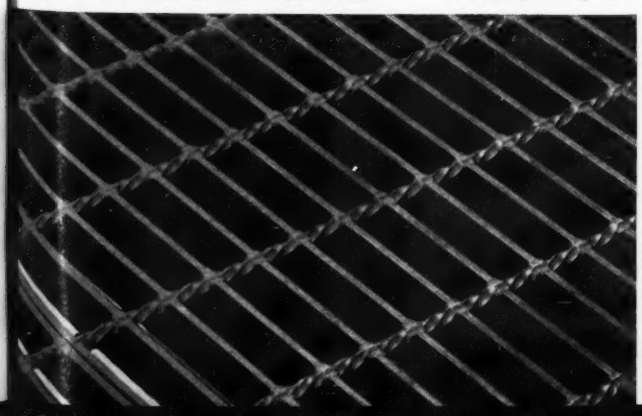


TABLE OF SAFE LOADS BLAW-KNOX ELECTROFORGED GRATING

SIZE OF BEARING BARS 1 IN. APART

Span, ft.-in.		2-0	2-6	3-0	3-6	4-0	4-6	5-0	5-6	6-0	6-6	7-0	8-0	9-0
¾x3/16	U	330	222	143										
	D	.085	.134	.192										
	C	330	265	215										
	D	.068	.108	.154										
¾x¼	U	500	320	217										
	D	.085	.134	.192										
	C	500	400	325										
	D	.068	.108	.154										
1x3/16	U	600	384	267	188	150								
	D	.064	.099	.143	.195	.256								
	C	600	480	400	330	300								
	D	.051	.080	.115	.156	.205								
1x¼	U	900	580	400	286	225								
	D	.064	.099	.143	.195	.256								
	C	900	725	600	500	450								
	D	.051	.080	.115	.156	.205								
1¼x3/16	U	950	600	420	303	232	184	146	120					
	D	.051	.081	.115	.157	.205	.259	.321	.389					
	C	950	750	630	530	465	415	365	330					
	D	.041	.064	.092	.125	.163	.207	.256	.310					
1¼x¼	U	1425	900	633	457	350	278	220	182					
	D	.051	.081	.115	.157	.205	.259	.321	.389					
	C	1425	1125	950	800	700	625	550	500					
	D	.041	.064	.092	.125	.163	.207	.256	.310					
1½x3/16	U	1365	880	610	445	340	266	220	182	150	128	110		
	D	.043	.067	.094	.131	.166	.216	.267	.324	.385	.440	.522		
	C	1365	1100	915	785	680	600	550	500	450	415	385		
	D	.034	.053	.077	.104	.137	.173	.214	.259	.308	.361	.418		
1½x¼	U	2050	1320	917	672	512	400	330	273	225	192	164		
	D	.043	.067	.094	.131	.166	.216	.267	.324	.385	.440	.522		
	C	2050	1650	1375	1175	1025	900	825	750	675	625	575		
	D	.034	.053	.077	.104	.137	.173	.214	.259	.308	.361	.418		
1¾x3/16	U	2800	1780	1230	915	700	544	440	364	308	262	228	175	133
	D	.038	.057	.082	.112	.147	.185	.229	.276	.330	.387	.450	.580	.737
	C	2800	2225	1860	1600	1400	1225	1100	1000	925	850	800	700	600
	D	.029	.046	.066	.090	.117	.148	.183	.221	.264	.308	.358	.468	.593
2x3/16	U	3650	2340	1618	1200	912	723	580	482	400	346	293	225	178
	D	.032	.050	.072	.099	.128	.163	.201	.243	.289	.341	.397	.516	.651
	C	3650	2925	2425	2100	1825	1625	1450	1325	1200	1125	1025	900	800
	D	.026	.040	.057	.078	.102	.129	.160	.193	.230	.269	.314	.409	.518
2¼x3/16	U	4650	2960	2065	1515	1150	912	740	608	516	438	379	288	228
	D	.027	.044	.064	.087	.113	.148	.177	.214	.255	.305	.349	.455	.574
	C	4650	3700	3100	2650	2300	2050	1850	1675	1550	1425	1325	1150	1025
	D	.023	.035	.051	.070	.091	.115	.142	.172	.204	.240	.279	.364	.460

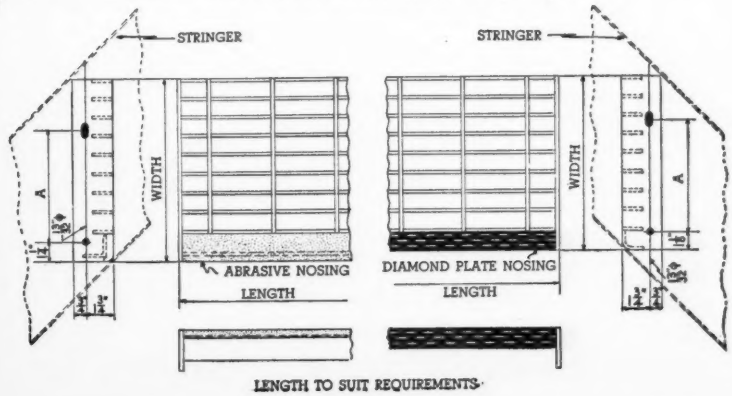
C — Safe concentrated load in pounds per foot of width

U — Safe uniform load in pounds per foot of width

D — Deflection in inches

Spans to right of heavy line not recommended

Maximum allowable fiber stress 16,000 lbs. per sq. in.



Demand
Lloyd
Products
FOR PERFECT PERFORMANCE
Lloyd products are listed and approved by Underwriters' Labs., Inc., and Canadian Engineering Standards Assoc. Starters FS-2—FS-4 also certified by Electrical Testing Lab., Spec. 6. Patent Nos. 2200443-2228210.
Certified to Fleur-O-Lier Standards
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Nicopress
The Modern Splice for Distribution Lines
Strong, tight, neat, durable splices that have a lasting high conductivity are assured with Nicopress.
Any lineman can make them in minimum time without danger of damaging the conductors. As Nicopress power sleeves are bevelled at both ends they pull easily over crossarms without snagging.
Made in a wide range of sizes for copper, copperweld or steel conductors, solid or stranded.
ORDER NICOPRESS FROM YOUR JOBBER.
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THE NATIONAL TELEPHONE SUPPLY CO.
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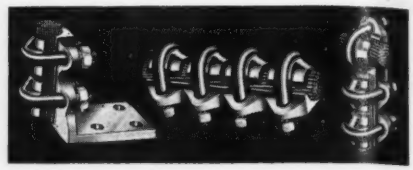
Canadian Manufacturer — N. Slater Company, Ltd., Hamilton, Ontario
Export Distributor — International Standard Electric Corporation, New York, New York

Connectors (912)

Penn-Union Electric Corp. is offering a new line of connectors, including straight connectors and reducers, tees and terminal lugs. According to the manufacturer, each fitting can be used for a wide range of con-

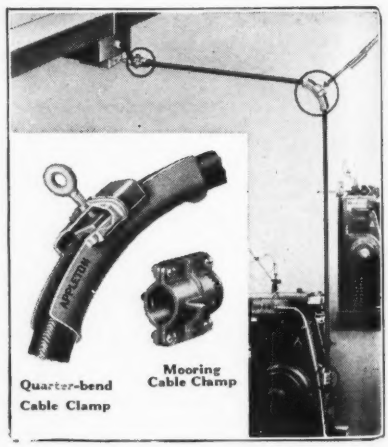


ductor sizes, one tee, for example, taking any cable from 1/0 to 300 mcm. on either run or tap.

Included in regular stock are straight connectors and reducers with two, four or more bolts; tees with one or two bolts on run and tap; terminals with any number of bolts, straight or angle flanges, variously drilled. Each is made for a complete range of cable sizes up to 2,000,000 cm.

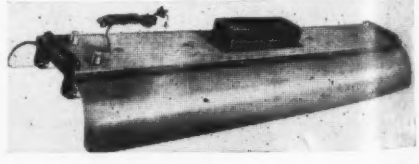
Cable Clamps (913)

New cable clamps for exposed industrial wiring have been designed by the Appleton Electric Co. for use where it is necessary to run cable instead of conduit for machinery installation. The line includes a quarter-bend and a mooring clamp.

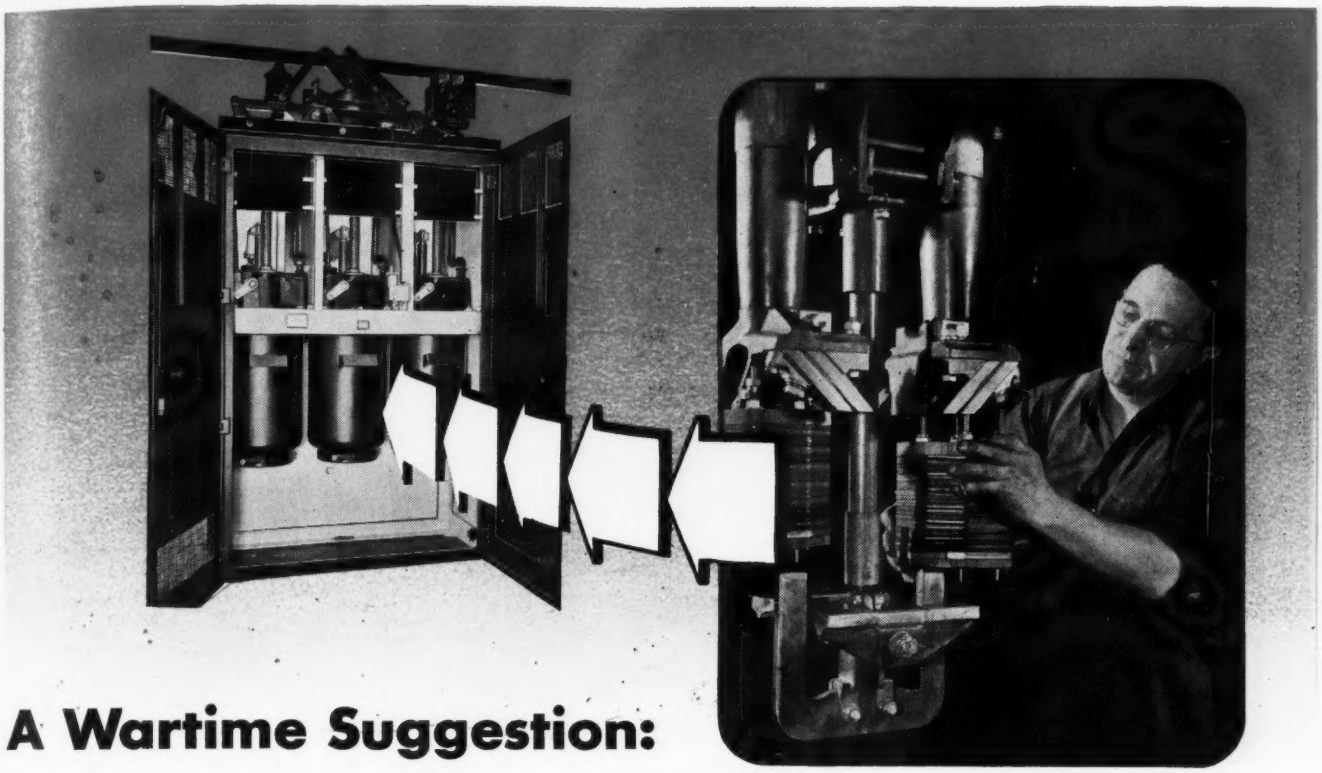


Fluorescent Fixture (914)

A new "flat top" Liberty model fluorescent lighting unit is being manufactured by the Tru-Ad Co. These fixtures are available for two, three or four 40-watt lamp units and two 100-watt units. Non-metallic, Masonite reflectors are said to conform to design and specifications of U. S. Bureau of



Standards and to produce a reflection value of more than 83%. Inside finish is white, outside grey baked enamel. These units are ETL certified and have been approved by Underwriters' Laboratories, the announcement states.



A Wartime Suggestion:

when new breakers can't be bought . . .

ADD NEW LIFE TO OLD BREAKERS

with Westinghouse "De-ion Grids"

As system loads grow greater, breaker interrupting capacities must also be increased.

Where new breakers can't be obtained to meet such needs, a time and cost-saving solution in some cases, is to rebuild existing Westinghouse oil breakers to include modern "De-ion Grids".

For example, one Southern utility recently found it necessary to improve the performance of some of their indoor breakers to take care of war-expanded loads. New breakers were unobtainable. So they modernized the breakers with "De-ion Grids" . . . gave them a new lease on life. Their capacities were increased as a result of increased efficiency . . . critical materials were saved.

In addition, system stability was improved . . . faster arc extinction greatly reduced the need for breaker inspection and maintenance.

Investigate the possibilities of modernizing your present Westinghouse oil circuit breakers with "De-ion Grids". Westinghouse engineers will gladly consult with you . . . give you the benefit of their knowledge and experience. Write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

WHAT "DE-ION GRIDS" CAN DO

RENEW BREAKER LIFE. Add years of service.

INCREASE SYSTEM STABILITY. High-speed opening of the circuit shortens fault time; greatly reduces system disturbances.

REDUCE OIL DETERIORATION and contact burning. With faster arc extinction, you can increase periods between oil conditioning, contact inspection and dressing.

INCREASE BREAKER CAPACITY. Modern, quick-quenching "De-ion Grids" speed opening action, may permit handling heavier loads with greater safety. J-60538

Westinghouse "De-ion Grids"

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Finer Appearance— Better Performance

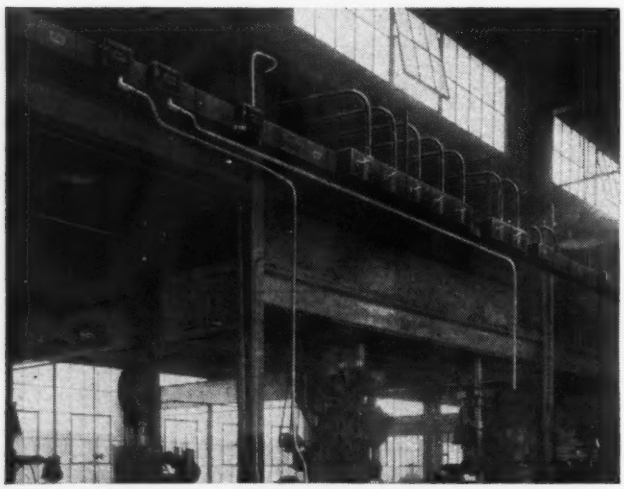
Yet It Saves Much Steel and Copper

In Conformity with WPB Limitation Order L-273

On Feeder runs, BullDog's Ventilated Type LO-X Duct puts more power through to branch circuits with less voltage drop. The screened casing not only improves appearance but prevents excessive heat—cuts weight—conserves a maximum of critical materials.

At the same time, Ventilated LO-X shares all the basic advantages of BullDog BUStribution Duct design. It is quickly and easily installed—has full asset value—is 100% salvable.

LO-X Ventilated Bus Duct for Main Feeders is available in the new WPB ratings of 800A, 1000A, 1350A, 1600A and 2000A. Single-phase, 3-phase, and 3-phase 4-wire; 600 Volts or less.



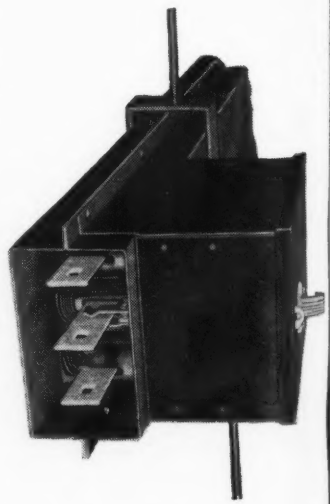
Flexible Light and Power

(Above) This shows a Branch Circuit run of BUStribution DUCT with circuit protective devices plugged in at points most convenient to the machines they energize and protect. Each 10-ft. section of plug-in duct has 10 outlets for the insertion of these plugs, which can be readily moved with the machines and instantly plugged in at any other desired location.

Capacities available under new WPB standards are 250A, 400A and 600A for branch runs of Plug-in Duct.

PLUG-IN TYPE FOR BRANCH CIRCUITS

(Right) End view of a branch circuit plug mounted on a bus duct section. Note how the copper "contact fingers" of the plug, inserted through a plug-in opening in the duct casing, clamp over the busbars in the duct.



Wiring between plugs and machines is made in short runs of rigid or flexible conduit.

Plugs may be of the fusible switch type or automatic circuit breaker type and are readily interchangeable. Capacities: 30A to 600A; 600 Volts or less.

You SAVE when you SPEND on WAR BONDS

BULLDOG

ELECTRIC PRODUCTS CO.
Detroit, Michigan

MANUFACTURERS OF a complete line of Vacu-Break Safety Switches, Panelboards, Switchboards, Circuit Master Circuit Breakers and BUStribution SYSTEMS.

BullDog Electric Products of Canada, Ltd., Toronto, Ontario

Field Engineering Offices in All Principal Cities

BULLDOG PRODUCTS ARE SOLD AND DISTRIBUTED BY THE FOLLOWING PACIFIC COAST REPRESENTATIVES:

Coast Electric & Manufacturing Co.
1720 N.E. Sixth Avenue
Portland, Oregon, Tel. Garfield 2844

Safety Switchboard & Manufacturing Co.
1445 Stevenson St.
San Francisco, Calif., Tel. Hemlock 2470

Mullenbach Electrical Manufacturing Co.
2300 East 27th Street
Los Angeles, Calif., Tel. Jefferson 2224

THE HAND IS CAPTIVE TO THE EYE

● M.I.D. — Material Inspection Department — is the first of many watchdogs that guard the quality of Sylvania Fluorescent Lamps. Before graduation from M.I.D. all materials must pass tough electrical, mechanical, chemical and visual tests.

Here an M.I.D. inspector is checking the quality of hair-fine tungsten, with a microscope, before it is released for fabrication into fluorescent cathodes.

The same painstaking care oversees each step of precision manufacture. When a finished Sylvania Fluorescent Lamp is ready for shipment to the war production front, it has to answer 49 quality questions. To pass this post-graduate course, it has to be the finest in fluorescent.

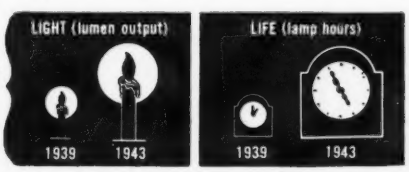
But the Sylvania standard of quality is not frozen into production. There are constant specifications and processing changes. Many of them, like the "Mercury Bomb" method of ultra-precise measurement, conserve metals and man power, but all of them serve to step up fluorescent performance.

Research results are more lumens per watt, longer life, a finer coating and more uniform light color. These are the good reasons why Sylvania Fluorescent Lamps can be specified, with full confidence, for replacements and for new installations authorized to promote visual efficiency in war plants.

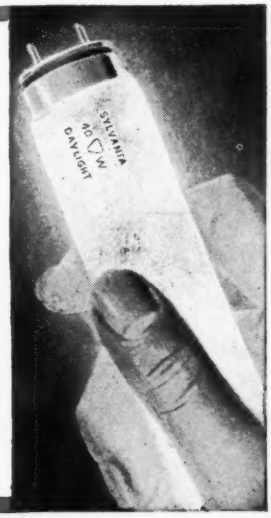
SELL SYLVANIA AND GIVE YOUR CUSTOMERS FAR MORE LIGHT AND LIFE FOR THEIR MONEY

Compared with 1939, a dollar invested today in Sylvania Fluorescent Lamps buys more than four times the lumen output and approximately five times the lamp life.

SYLVANIA FLUORESCENT DOLLAR BUYS:



(Based on decreasing price and increasing efficiency and durability of Sylvania 40-Watt White Fluorescent Lamp)



SYLVANIA

ELECTRIC PRODUCTS INC.

Formerly Hygrade Sylvania Corporation
Salem, Mass.

INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

File....but

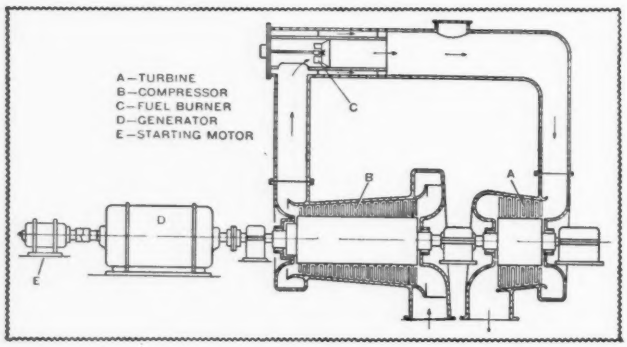
NEW IDEAS IN POWER AND ELECTRICAL EQUIPMENT ARE TAKING

AVAILABLE UNDER HIGH PRIORITIES....ALL BELONG IN THE

☛ Power plant of the future probably will be built around gas turbines... operating at efficiencies equal to or better than diesels but with the low maintenance and simple lubrication of steam turbines. Building space per unit output will be lowest of any prime mover and no water will be required.

Present signs: already 19 Allis-Chalmers gas turbines and compressor units are employed in refining high-octane gasoline.

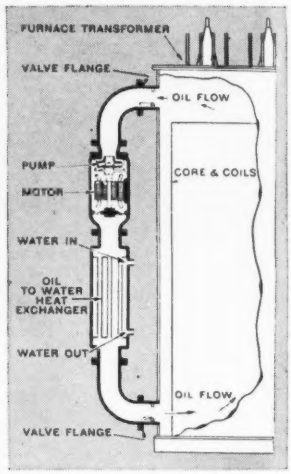
Operating sequence: 1) starting motor slowly rotates unit, building up air pressure, 2) fuel burner is ignited and hot gas enters turbine, 3) turbine takes load, drives compressor and generator, starting motor is disconnected.



OPERATING DIAGRAM OF MODERN COMBUSTION TURBINE

☛ Just moving oil faster in special transformer radiators — cools it enough so that designers need less copper and steel in transformer cores and coils. Allis-Chalmers "Electro-Cooler" does just that—but what's more it's done so simply that it makes forced oil cooling practical. That's the magic word—PRACTICAL!

So now that water-cooling coils are banned by WPB—and electric furnace transformers must be built without them—the "Electro-Cooler" with an oil-to-water heat exchanger replaces them. Allis-Chalmers transformer engineers save copper tubing—give steel makers a substitute for the water-cooled furnace transformer.



OIL-TO-WATER "ELECTRO-COOLER"

Investigate the widening applications of the "Electro-Cooler"—a unit composed of a heat exchanger and a "pump-in-a-pipe." Motor and pump are both immersed and lubricated by cooling oil.

☛ In the heart of a mercury arc rectifier, power-carrying electrons await the moment when a flash of bluish lightning will carry them from the anode to the cathode. There's one anode in each tank of a 6-tank Allis-Chalmers "Excitron" rectifier. Every 360th of a second, in sequence, bluish arcs flash in these tanks. What is the wizardry that times these arcs?

Excitrons are built to "fire when ready"—a procedure made possible by continuous excitation!

At the precise moment that a-c voltage on the anode equals the internal resistance of the mercury vapor gap—the bluish arc "train" leaves for the cathode.

WE WORK FOR VICTORY WE PLAN FOR PEACE

ALLIS-

don't forget

SHAPE FAST AT ALLIS-CHALMERS TODAY. SOME ARE ALREADY BACK OF EVERY LONG-RANGE PLANNER'S HEAD. HERE ARE A FEW:

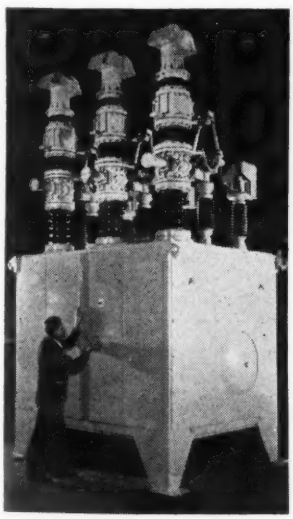
Six pilot arcs burning steadily do the trick—they're always ready to start the "trains" on the 360th of the second. Herein lies the simplicity and stability of the Allis-Chalmers "Excitron."

High priority wall surrounds "Excitron" today, prevents all but most essential uses.

But plan to use it postwar. Higher efficiency of "Excitron" suggests profitable replacement of thousands of motor generator sets and synchronous converters.

☛ Keep your eye on stronger trend toward air blast circuit breakers. Past year has seen Allis-Chalmers air-blast installations more than doubled.

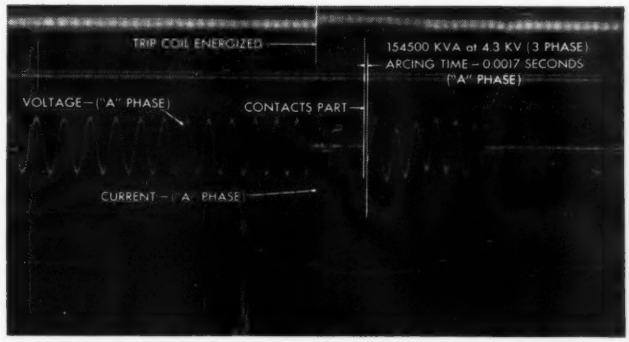
Think of air-blast breakers in terms of protection and maintenance savings. Arcing times, less than 1/2 cycle throughout operating range, mean amazing contact life.



1,000,000 KVA AIR BLAST

Here's how it works in brief: small contact piston pulls back from orifice, high pressure dry air rushing into hole. Arc rushes through, too . . . stretches out and vanishes—at split-cycle speed.

Reliability? Air brake systems of heavy trains are no safer.



OSCILLOGRAM OF AIR BLAST INTERRUPTION

☛ Biggest graphite "pencils" in the world write the flaming story of armor in the electric arc furnaces of Uncle Sam. Formerly these pencil-like electrodes were misguided by erratic up and down movements—calculated to keep pace with the melting charge. But at 3000 deg. F—overtravel and under-travel just burned them up and caused inefficient melting.

With a new sensitive, wide-range control generator called the "Regulex" exciter — Allis-Chalmers engineers are keeping furnace arcs constant, enabling extra "heats" per day, conserving graphite electrodes. Steel men are happy now!

Basic fact is that amplifying characteristics of "Regulex" exciter parallel in many respects those of the electronic tube—with the important exception that it has d-c machine life and ruggedness.

Look for other important new developments in electrical and power equipment from Allis-Chalmers. Maybe we can help you — maybe you can help us. ALLIS-CHALMERS, MILWAUKEE, WIS. A1612

-CHALMERS

100H UNIVERSAL MATTHEWS FUSE LINKS

COVERED BY PATENTS 1,797,850, 2,067,577 AND PATENTS PENDING

BEST FOR CASCADING

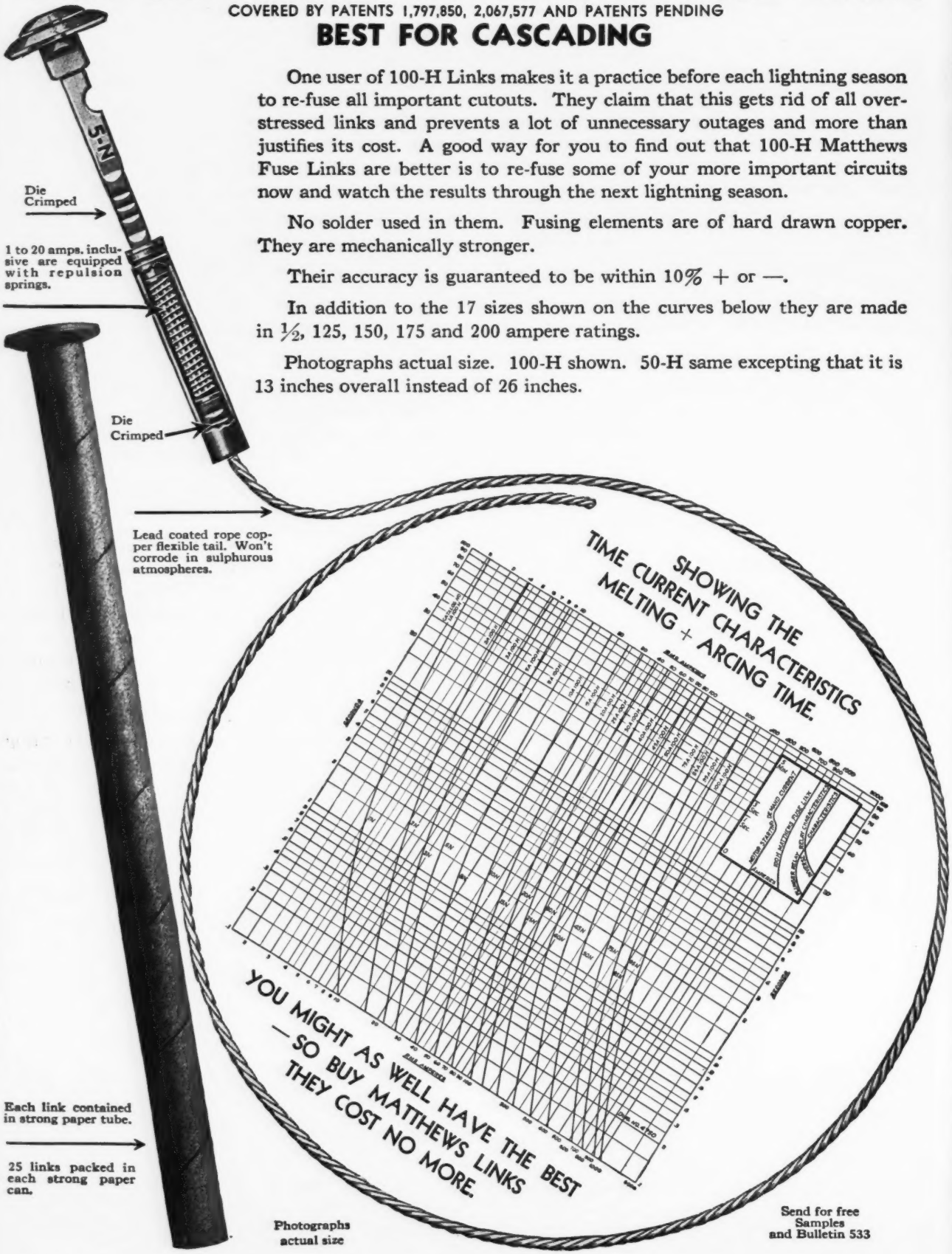
One user of 100-H Links makes it a practice before each lightning season to re-fuse all important cutouts. They claim that this gets rid of all over-stressed links and prevents a lot of unnecessary outages and more than justifies its cost. A good way for you to find out that 100-H Matthews Fuse Links are better is to re-fuse some of your more important circuits now and watch the results through the next lightning season.

No solder used in them. Fusing elements are of hard drawn copper. They are mechanically stronger.

Their accuracy is guaranteed to be within 10% + or —.

In addition to the 17 sizes shown on the curves below they are made in ½, 125, 150, 175 and 200 ampere ratings.

Photographs actual size. 100-H shown. 50-H same excepting that it is 13 inches overall instead of 26 inches.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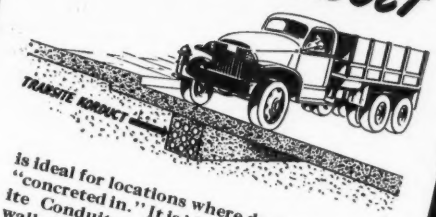
Die Crimped
1 to 20 amps. inclusive are equipped with repulsion springs.
Die Crimped
Lead coated rope copper flexible tail. Won't corrode in sulphurous atmospheres.
SHOWING THE TIME CURRENT CHARACTERISTICS MELTING + ARCING TIME.
YOU MIGHT AS WELL HAVE THE BEST —SO BUY MATTHEWS LINKS THEY COST NO MORE.
Each link contained in strong paper tube.
25 links packed in each strong paper can.
Photographs actual size
Send for free Samples and Bulletin 533

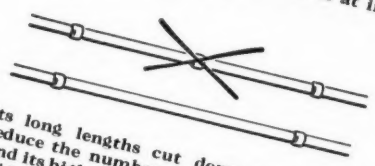
W. N. MATTHEWS CORPORATION, ST. LOUIS, U. S. A.

WHAT'S THE DIFFERENCE BETWEEN TRANSITE *Conduit* and TRANSITE *Korduct*?

TRANSITE *Korduct*



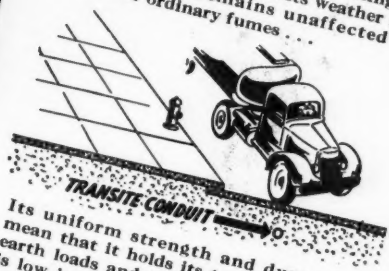
is ideal for locations where ducts must be "concreted in." It is identical with Transite Conduit, except that it is thinner walled and lower priced. It saves at installation because . . .



its long lengths cut down on joints, reduce the number of spacers required. And its high rate of heat dissipation cuts cable operating temperatures . . . increases system capacity.

TRANSITE *Conduit*

is for use underground or on exposed locations without a concrete casing. It can't rust or rot . . . resists weather and corrosion . . . remains unaffected by smoke or ordinary fumes . . .



Its uniform strength and durability mean that it holds its true form under earth loads and traffic pressure. And it is low in cost . . . more economical in service than other materials of comparable strength and corrosion-resistance.

And here are characteristics that Transite Conduit and Transite Korduct have in common . . .

1. Incombustible . . . Made of asbestos and cement, Transite Ducts won't contribute to the formation of dangerous smoke, gases or fumes. When burnouts occur, they give maximum protection to adjacent cables and equipment.

2. Immune to Electrolysis . . . Transite Ducts are entirely inorganic, non-metallic, cannot be affected by electrolysis.

3. Smooth bore . . . Cable pulls and replacements are easier . . . damage to sheathings is minimized.

4. Easily installed . . . Their combination of light weight, long lengths and quickly assembled couplings speeds up work.

For details and specifications, write for Data Book DS-410. Johns-Manville at Los Angeles, San Francisco or Seattle.

JM Johns-Manville

TRANSITE DUCTS

TRANSITE KORDUCT— for installation in concrete

TRANSITE CONDUIT— for exposed work and installation underground without a concrete encasement

Heats in Winter Cools in Summer

For many years, Thermador Fan Type Portable Electrical Heaters have been providing comfort, convenience, and economy for American homes and plants.

Now they are essential in speeding war production by improving working conditions. Clean, compact, and safe, Thermador double-purpose units furnish warm air in winter—circulate cool air in summer. Flameless, fumeless Thermador Heaters are available on priority orders in portable or built-in types for use on 115-volt A.C. service, 1650 watts capacity, or 230-volt A.C. in capacities up to 5000 watts.

Thermador also manufactures built-in Electric Heaters, Electric Ranges, Electric Water Heaters, and Small Transformers.

Write today for Catalog EW4

THERMADOR
ELECTRICAL MFG. COMPANY
5119 South Riverside Drive
Los Angeles, Calif.
Seven Leagues Ahead

BULLETINS

data books, etc.

Cable Data Book (915)

The Okonite Co. has issued a data book on its varnished cambric cables. Containing 36 pages and a four-page supplement, the booklet was designed to aid in planning, installing and maintaining electrical circuits.

Contents include specification data, tests, selector chart, essential purchase data, protective coverings, conductor designs, construction data, current carrying capacities, conversion factors, voltage drop tables, conduit capacities, splicing instructions, terminating without potheads and other information.

The supplement is devoted to considerations for increased current loadings under wartime conditions and includes a table for finding reactance.

Electronics at Work (916)

Westinghouse Electric & Mfg. Co. has issued a 36-page booklet, "The ABC of Electronics at Work," describing the fundamental principles of the six basic ways in which electronic tubes function. Schematic drawings of the tube construction and diagrams showing typical circuits for the various functions are used to show how electronic tubes rectify, amplify, generate, control, transform light into current and current into light.

Maintenance Handbook (917)

An 88-page maintenance handbook has been prepared by Ideal Commutator Dresser Co. Designed to help keep motors and generators operating continuously at peak efficiency without dismantling, the handbook covers motor maintenance equipment, industrial electrical equipment, variable speed transmissions, machine tool accessories, wiring devices and tools.

Electric Instruments (918)

A publication discussing briefly characteristics of electric instruments, what makes them operate, and individual limitations of the various types has been issued by General Electric Co. Titled "Electric Instruments, Principles of Operation," the booklet contains 19 pages, 8 by 10½. Illustrated.

Testing Facilities (919)

Delta-Star Electric Co. is distributing a new publication, outlining its mechanical and electrical testing facilities. Described are million-volt surge generator testing equipment, oscillograph, optical comparators, Rockwell hardness tester, radio noise testing with diagrams, mechanical testing equipment and heat runs.

Insulating Varnish (920)

A six-page folder covering its Synthite PG-1 clear baking varnish has been issued by the John C. Dolph Co. Information on baking and vacuum impregnation of electrical units with insulating varnish is given.

Lubricating (921)

The Farval Corp. has published an eight-page bulletin describing the Multival lubricating system—a method of delivering lubricant under high pressure from a single grease-gun connection to a group of bearings in exact measured amounts.

Reconditioned Machinery (922)

A catalogue of its reconditioned machinery has been issued by Morse Bros. Machinery Co.

Electronics Primer (923)

Of interest to industrial engineers is a 24-page non-technical bulletin, "How Electronic Tubes Work," released by General Electric Co. Presented in primer form with 117 illustrations, this booklet describes the eight basic types of industrial electronic tubes and their uses.

Electrical Connectors (924)

Cannon Electric Co. has prepared a booklet on its Type DP rack and panel electrical connectors.

Enclosed Switches (925)

Frank Adam Electric Co. has prepared Bulletin No. 70 on enclosed switches, replacing Bulletin No. 59.

ELECTRICAL WEST, 68 Post St., San Francisco, California

Please send me information about following CIRCLED items:

900	901	902	903	904	905	906	907	908	909
910	911	912	913	914	915	916	917	918	919
920	921	922	923	924	925				

Name..... Company*..... Title*.....

Address.....

* Please include your company's name and your position, as we cannot ask manufacturers to furnish literature unless you do.

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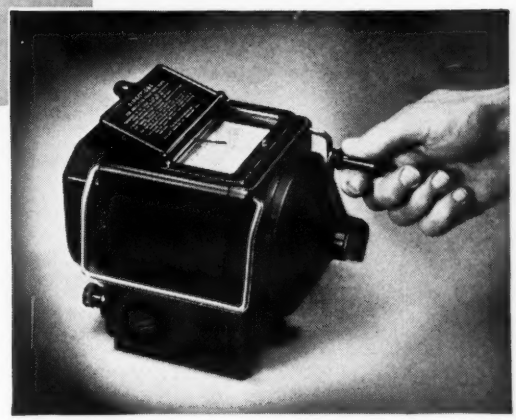
READY FOR USE



THE NEW "MEGGER"* INSULATION TESTER . . .

a worthy addition to the famous "MEGGER" family!

With our Philadelphia factory now in full production, your needs for "Megger" Insulation Testers can soon be met.

Our new U. S. models are of the same general design and are similar in every way to our well-known "Meg" and "Super-Meg" Insulation Testers, except that they are housed in plastic molded cases instead of aluminum. All internal parts are made to the same proven design and specifications as the "Meg" instruments,—without compromise or substitution of materials. The cases are of high impact strength plastic,—one of the strongest, toughest molding materials available. The entire instrument is built in our own plant by men and women who know how to make fine instruments. Our production is independent of the products of other instrument manufacturers.

We are fully confident that you will find these new Insulation Testers worthy members of the famous "Megger" family, and we invite your orders for them. At present we are offering ranges up to 100 and 1000 megohms with 500-volt generators. We continue to supply various other types and ratings of "Megger" instruments as formerly. Write for new descriptive Bulletin 1735-T.

MADE IN U.S.A.

- HAND-CRANKED GENERATOR
- DIRECT-READING OHMMETER
- SIMPLE
- RUGGED
- RELIABLE

*Trade Mark Reg. U. S. Pat. Off.

JAMES G. BIDDLE CO. · 1211-13 ARCH STREET · PHILADELPHIA 7, PENNA.

ELECTRA'S HUSBAND

"It's the War, You Know"

EVERY time Electra hears the statement, "It's the war, you know," made as an excuse for some laxity in courtesy or service, she flies off the handle. It's an alibi, she claims, for lack of discipline or training or for just sheer laziness.

Maybe it is sometimes, but it wasn't in the case of one of the better southern California hotels where one of Electra's friends was visiting. Occasion was one of those "war conferences" which is the name given to the garden variety prewar convention. most of which should be ruled out for the duration.

Anyway night festivities were in full swing at this conference with several of the meeting rooms occupied. Then the lights went out. Branch circuit fuses had blown for one whole section of the hotel. And no one could replace them. The manager was new. So was the engineer. And the electrician. Not one of them knew the location of the branch circuit panel boards. Nor could anyone find a circuit diagram.

Then someone remembered that the former electrician was working in a huge war plant over in Nevada. So a telegram was sent to him. The next morning word came back that the particular panel board in trouble was located back of the telephone switchboard. So the fuses were replaced and the lights came back on again.

"It's the war, you know."

WHEN it comes to accidents, a little knowledge is a lot more dangerous than no knowledge at all. Especially is that true about electrical equipment. Recently a part of the California State Guard engaged in some maneuvers. Site was an old Army barracks in the desert, unused for some months. Electric service had been discontinued and the drops removed. However, the transformer which formerly fed the barracks remained in place, although it had been disconnected on both the primary and secondary side.

Some of the boys had a radio and wondered why they couldn't get "electricity to play it." A sergeant volunteered to hook up the set. He secured two coils of wire and climbed the pole. Then he carefully skinned the ends of each coil and tapped them to two phases of the 2,300-volt circuit. Apparently he thought this was a secondary lighting circuit. He climbed down the pole and began uncoiling the wire. Then lightning struck. In the parlance of the line gang, he was knocked kicking. So was one of his buddies who tried to help him.

Finally some of the group took sticks and pried the sergeant loose from the wire. He was lying on the ground, apparently dead. No one had ever heard of the prone pressure method of resuscitation. So he lay there until an ambulance came and carried him away to the hospital. Apparently the shaking up in the ambulance revived him, for he regained consciousness shortly after arriving at the hospital. Reputedly, he was heard to murmur that he "was a tough guy and could take it."

SALESMEN will have jobs again, despite what some of them think. When they do, perhaps they will benefit from a salesman's creed which Electra clipped out of one of the magazines that come to the house. It was written by a branch manager of Seattle's Crescent Manufacturing Co. (they make a man's favorite coarse-ground black pepper, along with a lot of other condiments). Here it is:

"This is my conviction: I am ordained to represent a product in which I have implicit faith. My obligation is to extend by precept and example the dignity and integrity of my principal and the articles it sponsors. I pledge to conduct myself at all times in a manner that will never cast aspersions on the good name of my superiors or associates.

"I consider that I am the color guard assigned to carry the banner of 'my house'; to keep it unsullied. I will hold it high so that all may see to honor that for which it stands.

"I assume the duties of an evangelist. I will never stoop to any practice in dealings which I do not believe is a benefit to both seller and buyer. My demonstrations shall eternally design for future goodwill rather than personal advantage. I refuse to negotiate a sale until I am sure the transaction will be of mutual advantage to all concerned. I will build my works on a foundation of character with contacts to endure in the years beyond my activity so that my company and the product and the customer will feel grateful for my service.

"If ever my faith wavers in ability to religiously follow these principles set forth, I will quit my job."

Electra commends this to future utility lighting equipment salesmen, with special recommendation to electric appliance salesmen in general; vacuum cleaner salesmen in particular.

WAS my face red the other night when Electra publicly pinned my ears back for a juicy morsel of industry gossip I had taken home a few days before. It was one of the "hush-hush" stories about postwar developments. And it came fresh out of the East. X-Company was going to manufacture a revolutionary cooking appliance. Using ultra short waves such as are employed in some of the war industry heating applications, the new device would cook by electronics. It would bake a potato before you could say "Jack Robinson." And it would broil steaks in less time than it would take a fast eater to inhale his soup. But it was all still very secret.

Anyway, it made a swell story as I told it to Electra.

So imagine my embarrassment a few nights later, when I started to tell the story to some guests, and Electra interrupted me.

"Don't you ever read the ads?" she asked.

"Why certainly," I answered just a little petulantly."

"Well, I guess you didn't go over the current issue of the S.E.P. very carefully," she said, walking over to a table where that magazine lay along with several others. Turning to a one column advertisement by one of the large manufacturers she read almost verbatim some of the things I had been repeating. The message told the public that this was one of the developments which might be expected.

WHILE on the subject of postwar kitchens, I can report that Electra had a pat answer to every technical and engineering objection I could raise about the Libbey-Owens kitchen-of-the-future pictured in a recent issue of *Life* magazine. It was, "I don't care, I want one like it after the war."

...by O.S. in power plant's turbine!

"HOURS OF OPERATION" alone does not determine the quality of a turbine oil. More important are the characteristics of the oil during a given period. Did the oil need purification? Was make-up oil kept to the minimum? Did the system and the oil show rust? These are the sort of things that determine whether your turbine is operating economically, trouble-free.

One of the many outstanding performance records of Shell Turbo Oil is indicated in the analyses shown at the right. Note how little change took place even after 24,483 hours of continuous operation. Here is definite proof that Shell Turbo Oil has superior oxidation stability. It also prevents rust. Can the turbine oil you now use match this? Draw off a sample and see.

For details on this and other outstanding performances of Shell Turbo Oil see the Shell man. Or, write Shell Oil Company, Inc., Dept. "E," 50 W. 50th St., New York, N. Y., or 100 Bush St., San Francisco, Cal.

SHELL TURBO OIL

Currently, the U.S. Navy has first call on Shell's entire production of marine turbine oil

CERTIFIED PROOF OF THE SUPERIOR

* OXIDATION STABILITY

OF SHELL TURBO OIL

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156	*Viscosity @ 100° F.*	159
Clear	*Appearance*	Clear
.05	*Neutralization No.*	.05
.1	*Saponification No.*	.3

Performance record of Shell Turbo Oil in a 6,000 kw. unit of a large utility company in the Southwest.

EVERYTHING YOU NEED

FOR EVERY TYPE OF

Outdoor Lighting

Not only the latest, most efficient designs in standards and luminaires, but transformers, cutouts, relays, glassware, time switches . . . everything for effective outdoor lighting for street, highway, or sports. Write to Main Offices, Milwaukee, Wisconsin, for outdoor lighting information.

LINE MATERIAL COMPANY

ELECTRICAL WEST

SEPTEMBER, 1943
VOL. 91 NO. 3

Plan Now for Postwar Lighting Promotion

Sales plans must be blueprinted now to capitalize on whetted public appetite for better lighting; market possibilities, personnel discussed

O. R. Doerr

General Sales Manager
PG and E, San Francisco

DISCUSSION at this time of future lighting possibilities may appear somewhat incongruous to many on the Pacific Coast who now are living under enforced dimout regulations and are being importuned in the interest of the National Conservation Campaign to resort still further to economies. Nevertheless, a great deal of thought, research and planning on the subject of postwar lighting sales promotion will have to be done before the GO signal is flashed when Victory comes, if the electrical industry is to make the most of the golden opportunity in lighting that lies ahead.

Some may suggest that the problem be allowed to rest in "moth balls" until the war is won. The answer is obvious. All will readily agree that nothing should be done that will in any way interfere with the No. 1 job of winning the war. On the other hand, full cooperation and aid in the war effort does not and should not preclude some serious thought as to the future.

Every business agency in the country is looking with envious eyes upon the consumer's postwar dollar. Lighting men believe that they have one of the greatest dollar values of all to offer this market and we will be most shortsighted, indeed, if we too do not forge our sales tools well in advance of V-day in order that the public's whetted appetite for better lighting be turned into sales and kilowatt-hours immediately upon the availability of equipment.

Let's first take stock of the present situation and look back to see where we left off when war came in order that we may approach our planning job with proper perspective.

Residential Lighting

Betterment of indoor general illumination has been suspended practically at the 1941 level with a gradual deterioration since that time due to fixture obsolescence, empty sockets, and down-lamping which started shortly after the introduction of the Mazda lamp restrictive orders. This situation can be expected to continue in this direction for the duration. Outdoor, garden, and residential exterior effect-lighting has been extinguished. Some shielding of entrance and porch lights has been done.

Slow but sure progress was being made in bettering the lighting situation in the home in the years preceding the war, due in large measure to the Better Light-Better Sight campaign.

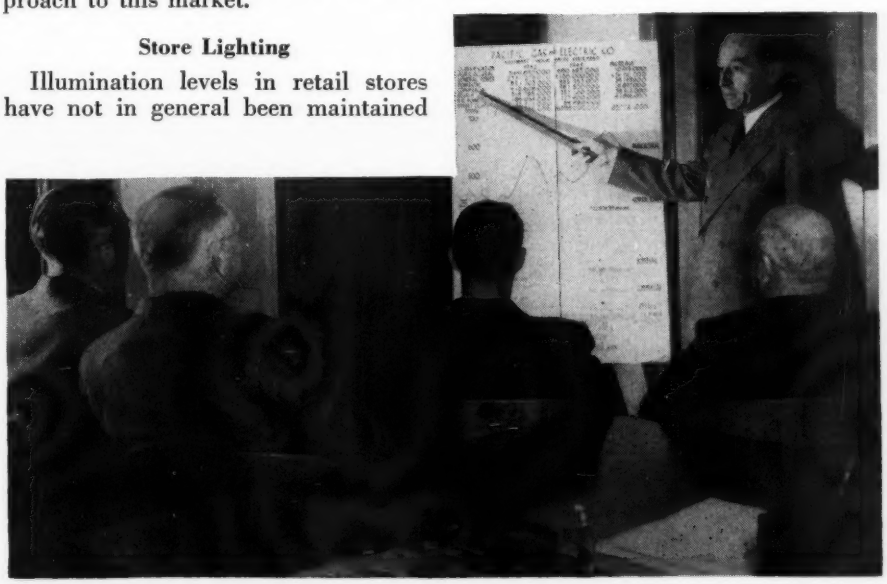
The public will emerge from the war highly light conscious—that is certain—and the home offers one of our most promising fields for higher intensities. It is safe to say that we have sold so far only about 25% of our market possibilities in the home. This leaves a long way to go, but with the introduction of fluorescent into the residential field, which seems definitely in the picture, we will have an entirely new approach to this market.

Store Lighting

Illumination levels in retail stores have not in general been maintained at prewar levels. Labor shortages, neglect and just plain excuses have been the chief contributing factors. Lighting levels in stores probably average about ten foot-candles. This has possibilities of taking a three or four times jump all in one step. Already there are a number of fluorescent jobs ranging from 40 to 60 f-c., and each store that modernizes lighting after the war will be forced to think in terms of that general level. This market insofar as the more progressive merchants are concerned will partially sell itself because one store modernized to these higher intensities will influence like stores to meet the competition. One department store will set the pace for all. Further intensive selling will hasten this transition from twilight to daylight in our retail stores.

Window Lighting

Window lighting is of course in a sorry plight. Competition between merchants after the war will no doubt



be a major influence in bringing this lighting back quickly. Just as modernization of interior lighting will be stepped up, so will window lighting. It is a question as to which can be done first. Obviously, both jobs should be sold together, if possible.

Office Lighting

Except for some strictly war tenants where expansion programs under priority assistance were undertaken, office lighting has remained about static. Office building ownership and management, however, is keenly alive to the value of good lighting in meeting competition. New office building construction may be expected to be relatively slow after the war because of the large amounts of space that will be vacated by government agencies and purely war industries. This means a highly competitive situation between buildings for tenants. Modernization will be their chief weapon and lighting should be the No. 1 job.

Progress was being made before the war in raising the standards of office lighting, but today the office building manager finds himself in a quandary as to which way to turn if he did want to improve his lighting. He went into fluorescent feeling his way, not entirely certain that it was the whole answer. His experience with fluorescent as a light source has been satisfactory, but his experience from a maintenance standpoint has caused him some concern. After the war he will still be on the fence to some extent and will need a lot of reassuring and selling.

Industrial Lighting

In this field great strides have been made during the war. Widespread distribution of war contracts in the West has brought about wholesale factory building conversion, expansion and improvements. In many cases lighting was included in these projects.

Factory lighting received very little attention in the decade of the thirties. A survey made early in that period indicated an average general intensity of about three or four foot-candles, with very little localized lighting. The level for general industrial lighting today is 20 to 25 f-c with localized lighting of from 50 to 250 f-c. Most of this new lighting is fluorescent with mercury and incandescent trailing. The progress of the past two or three years has probably doubled or trebled the low average of ten years ago.

A few defense plants will continue to have good wiring and lighting. Refixturing and rearrangement of lighting systems in a number of present war plants will generally be necessary. Some shipyards that will continue operation after the war are examples of plants which will have to make adjustments. The small plants that have jumped into war production by the addition of a machine or so, but no new lighting, will continue to be a problem in industrial lighting operations.

Here again, however, many factors and influences have been at work that give the lighting man his approach to this market. Tens of thousands—millions—of men and women have been working in war plants under good lighting conditions and their appreciation of the value of good lighting is bound to manifest itself in many directions. Plant owners and operators, also, have seen the value of high intensity lighting in speeded up production, lower accident rates, better products, fewer rejects, and better industrial relations.

Then there is this so-called three dimensional seeing, which is the proper application of paint and light to increase contrasts around machine tools —a new sales tool that is only beginning to be put to use. All these factors have played beautifully into the hands of the industrial lighting salesman. The war has already partly done his selling job for him. His main job is to "keep the ball rolling" and watch out that the whole thing doesn't backslide on him.

Service Station Lighting

Service station lighting has been reduced to twilight intensities—about 20% of normal. Light is one of the service station's chief sales weapon and this class of business not only will return to prewar levels, but will go much further with some pretty fancy lighting jobs, perhaps with liberal use of high-voltage continuous tube fluorescent. With our help the majors will blaze the trail and the innovations that will be intriguing to this type of business can be engineered into proper lighting installations.

Sports Lighting

Sports lighting is of course out for the duration. However, with the emphasis that the war has placed on physical fitness, it is certain that we may expect to see a marked expansion in the future use of sports lighting. The trial and error period in this field of lighting is long passed. Plenty of well engineered equipment is on the market—the need exists—the answer is obvious.

Sign Lighting

All of our signs and billboards are dark for the duration. This means rehabilitation at a cost including painting of certainly not less than $20 per sign. It is estimated that there are at least 75,000 signs in California alone and another 50,000 in the other ten Western states. This means a market of at least $2,500,000 for labor and materials to say nothing of the restoration of this load. New signs average in the neighborhood of $200 in value and our estimated immediate market for 10,000 new signs represents another $2,000,000 worth of business. These figures would not include signs under current lease, in connection with which maintenance is still being rendered.

Street and Highway Lighting

Anyone who has driven around the streets of our coastal cities at night or along the coast highway north of Santa Barbara needs no sales talk on the value of street and highway lighting. The public will emerge from this dimout era in a highly advanced stage of thinking on the subject. In fact, it will probably demand that something be done in a hurry about this class of lighting.

With the millions of dollars of new highways and highway and street improvements on the plan boards, right now is the time to see that proper lighting is incorporated into these projects.

School Lighting

School lighting is status quo. It has been a long hard pull. School districts and school boards seem always to be as poor as the proverbial church mouse and it has been difficult to do much with existing installations. Nevertheless, the need is great and progress has been made.

The Better Light-Better Sight movement and all the good work done by the lighting industry has had its telling effect and with the emphasis that the war has placed on education and the facts it has uncovered on illiteracy and mathematical backwardness in our citizenry, the educational institutions are going to be very much in the limelight after the war. School lighting is due to break into the open and really come into its own. A large school construction program, because of the westward population shift, is in the making and we must see that each and every one of the new schools is properly lighted.

Sales Planning

With all these glowing market possibilities in every field of lighting, how then are we going to do the big selling job that lies ahead? Of some things we can be certain.

1. The trend of public desire will be toward better lighting, and immediately when it is available to them. (Lighting has been starved to a greater degree than almost any other service.)

2. Lighting equipment will be available as soon, or sooner than other ap-

pliances and devices, thus giving us an opportunity to get a fair and early share of the consumer's postwar dollar.

3. New light sources and other technical developments render much lighting obsolete, thus opening the way for replacement business as well as new markets.

4. Educational facilities must be provided on a scale greater than heretofore, to enable industry to properly utilize new light sources, controls, wiring, etc.

It is a certainty that we can rely upon manufacturers to be ready with equipment, lamps and other tools needed for the job. It is our job to perform the other necessary functions of preparation, in order that the equipment and tools made available to us can be presented to the market which, when peace comes, will be eager to exchange its wartime experience of little light for adequate illumination. Specifically, we should plan along the general lines indicated in the following outline.

8-Point Postwar Lighting Plan

MAKE your Postwar Planning concrete. Specific action is prescribed. Several months will be required to make surveys and coordinate the plan. Do not wait until "V-Day." Combine your planning with your effort to win the war. Be ready when action is needed.

1 *Make a Field Survey of Lighting Conditions.* Survey customers' premises to determine which establishments are properly equipped to continue "as is" after the war, which must be wholly revised, or partially revised and, of the latter, what changes are necessary to properly serve peacetime operations. Make rough estimates of the cost of relighting and rewiring. Post this information on cards or sheets and file for ready reference. Use competent men for this work—otherwise your effort will be wasted. A summary of this survey will indicate the potential market in your community. Of course, this must be an "as, when and if" job dependent upon available manpower and many other factors.

2 *Prepare a Training Program for Salesmen.* Really good lighting salesmen are going to be scarce after the war. Salesmen will be available in two classes: (1) a few experienced lighting engineers, and (2) young college men and novices who must be completely trained. For the first class, refresher courses will suffice. For the inexperienced men, be prepared to train them in fundamentals, in lighting application, in general layout and wiring and switching arrangement, and in figuring the economics of owner cost and operation. Make this a specific training operation for sufficient length of time to train the personnel adequately.

It is certain that a more widely trained and a higher type of lighting engineer will be required postwar to select properly and apply the wide variety of point and linear type light sources which will be available. Furthermore, with the new exposed and larger light sources already available, the factors of relative surface brightness, the relationship of the surroundings and the necessity of more efficient light control will require better engineering in application.

To help solve manpower problems, it is suggested that the industry keep in touch with experienced men now on leave to the services.

3 *Prepare a Sales Program for Action.* In a general way prepare a sales plan just as though you were going to put it into practice in your own organization *tomorrow.* It must be geared to use new types of equipment, properly engineered to supply higher levels of illumination. It must definitely outline your scheme of cooperation with other agencies, your approach to the ultimate purchaser, and your objective. Remember that the competition for your share of the customer's dollar is going to be keener than you have known it to be. Also remember that obsolescence and the real need of modernization have been accumulating all through the war period.

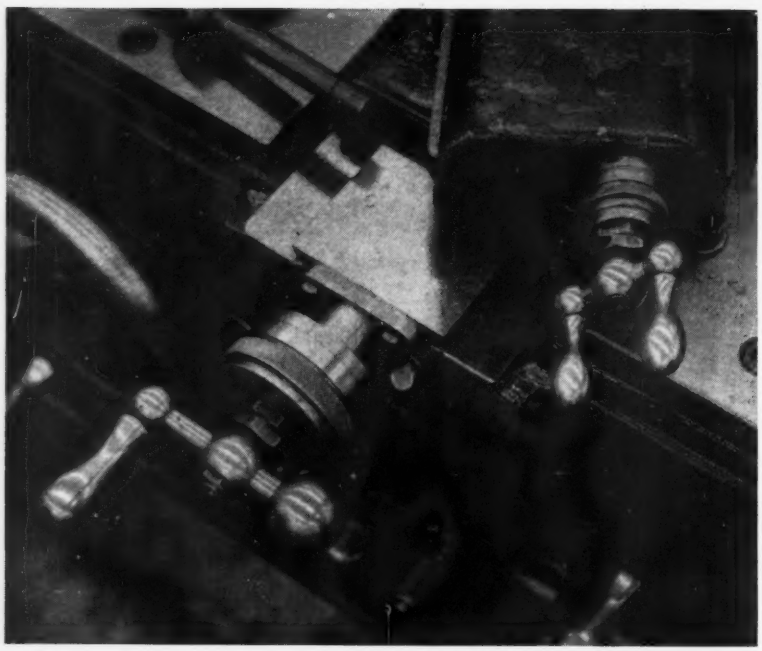
4 *Hold Meetings with All Classes of the Electrical Industry Involved.* The manufacturer, the wholesaler, the retailer, the contractor and the utility must all sit down together to summarize the situation and coordinate ideas. Each branch of the industry must be fully cognizant of plans and objectives of all other branches. All branches and agencies must agree on good sound plans and approaches. This will eliminate controversy as to what lighting level is best, the number and types of fixtures to be sold, and the cost and satisfaction which will result. For the sake of more certain selling let us all tell the same story.

5 *Cooperate With All Civic Organizations to Celebrate Victory With a Big "Light-up" Event.* Be prepared to take full advantage of any local or nationally-laid plans to celebrate the conclusion of the war under the title "Light Up Day" or "When the Lights Go On Again All Over the World," "Light Up With Victory," etc. Well organized committees are already set up locally and nationally to "turn on the light" and *so far as possible,* to restore prewar conditions. There are many ways to make the plan very effective.

6 *Plan Advertising and Publicity Campaigns.* Plan publicity and advertising now. Determine the media to be used, what type of customer education is most needed and the term during which customer determination and action must take place. Do not make it too long and be sure and discuss the objectives of the publicity and advertising plan with the sales organization before the copy is written.

7 *Plan for Sufficient Stocks of Fixtures, Lamps and Related Items.* Anticipate in so far as possible the kinds, types and cost of lighting fixtures and lamps which are to be available postwar. Make arrangements so that stocks of fixtures and lamps to meet postwar needs will be on hand without too much delay. Do not wait for brand new styles and types of fixtures. Present stocks which are likely to become obsolete should be moved before obsolescence is actually a factor.

8 *Build a Financial Reserve for Postwar Operation.* Large and small electrical concerns should begin now to set up financial reserves to finance promptly and adequately the class of business they expect to handle postwar. The market may be larger than most of us realize.



Accurate reading of micrometer dials is easier when lighting is from continuous line sources placed perpendicular to cylindrical surfaces

Critical Seeing on Critical Materials

Maximum production and reduced waste of materials requires tailored lighting, especially for difficult inspection tasks

*H. J. Chanon**

Illuminating Engineer, South Pacific Division,
General Electric Lamp Department, Los Angeles

THE *Official Plan Book* of the War Production Board lists "good lighting" as one of the important factors in the country's effort to get the maximum utilization from existing tools and machines.

Production is dependent on illumination—natural or artificial. This is an obvious fact, for no one can work in the dark. Anyone can do *some* work with a little light, and *more* work with more light. Many plants, particularly in southern California, were fortunate in having generous window area which provided considerable natural light. The eight hour day shift took advantage of this, while the second and third shifts struggled along with whatever artificial light was available.

Blackout regulations changed this picture, and following the removal of glass, the artificial lighting requirements for the day shift were no different from those for the remaining two. During the relatively short period that this country has had to prepare for this unprecedented requirement for material production, great advances have been made in industrial lighting. Those responsible for the new huge factory structures erected specifically to turn out war equipment, have provided good lighting and such factories enjoy levels of intensity never before attained with as little critical material. WPB has made one thing very clear by its general limitations orders. Since lighting systems require such critical materials as copper, steel, tungsten, etc., the WPB wants whatever lighting equipment that can be had, devoted to one thing, and that is lighting for production. In taking this position, it simply reflects what every other loyal American wants done also.

It is from these large plants that most of us get our industrial lighting impressions. Stories of their lighting systems appear in the various electrical papers and trade magazines and we are all inclined to think that America's industrial plant is very well lighted. Many of us also are inclined to think of industry as represented by enormous industrial plants. The fact of the matter is, that of the 184,230 industrial plants in the U. S., 178,772 or 97% of all plants employ fewer than 250 people.

These small plants represent 48% of the employees, 43% of the pay roll, and 47% of the dollar volume turned out. They have the job of turning out the subcontracted work which is so vital to maximum war production. How far the lighting in this large group of smaller plants has progressed is a matter of conjecture. It is known that a large percentage of them were designed for single-shift operation and the artificial illumination provided was designed largely to supplement whatever natural light was present.

It is in these plants that are to be found most of the so-called "lighting bottlenecks" that occur from improper lighting conditions. In the huge plants too, representing the 3% of American industry yet some 53% of the dollar volume of production, "lighting bottlenecks" exist also and we must recognize these and apply whatever corrective measures are necessary.

A few examples of general improvement from simple treatment, employing fundamental procedure, follow:

In one plant in which the poor daylight conditions existing at 4:30 p.m. in the middle of May on a day partially overcast, the daylight monitor skylight in the center of the plant produced 10 f-c. in the area immediately beneath it, and 1 f-c. at the sides of the room. An installation of continuous row fluorescent lamps produced an illumination of 35 to 40 f-c. throughout the room from wall to wall.

In another skylight plant "natural" illumination produced the highest intensity over aisle areas where the illumination was least needed. Two and three-lamp units with 40-watt F lamps produced an average illumination of 55 f-c. over the area of some 20,000 sq. ft. In a Detroit plant 35 f-c. in service was produced with 2-lamp 100-watt units on 10- x 13-ft. centers, mounted 15 ft. high.

Combination of 750-watt filament and 400-watt mercury lamps on 10- x 10-ft. centers and 36 ft. high produces 60 f-c. in service in one machine tool plant. To produce the color quality of light desired the filament and mercury lamps are alternately staggered. The high mounting height minimizes glare and insures a good mixture of the two types of illuminants.

Elimination of glare from local sources placed over machines in an attempt to bring up inadequate general illumination can often be accomplished, as it was in a Cleveland plant which had less than 2 f-c. of general illumination from 750-watt lamps on 40- x 70-ft. centers. The new system provides 35 f-c. average in service, with 3,000-watt mercury lamps on a nominal 35- x 40-ft. spacing. The bare lamps previously used at work places are no longer needed. In large room where the mounting heights of 40 ft. or higher are possible the 3,000-watt mercury lamp represents the most economical system from the standpoints of both cost and materials.

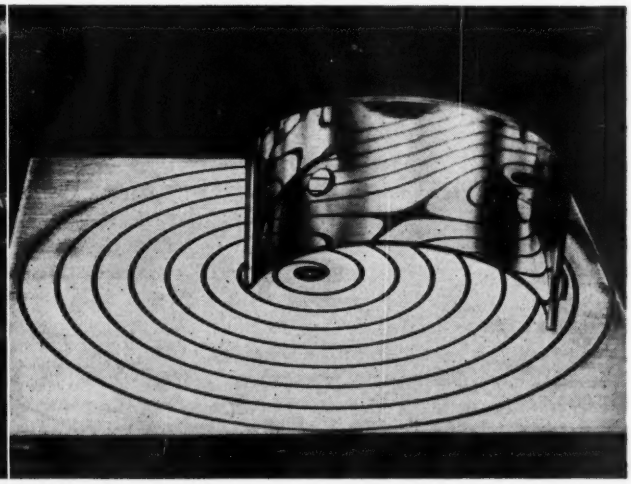
A large bomber factory in the southwest uses 2-lamp RF units parallel to girders, with a catwalk for easy maintenance, and gets 35 f-c. in service with

* A paper presented before the War Production Clinic, factory electrical equipment panel, University of Southern California, Los Angeles, April 30, 1943.

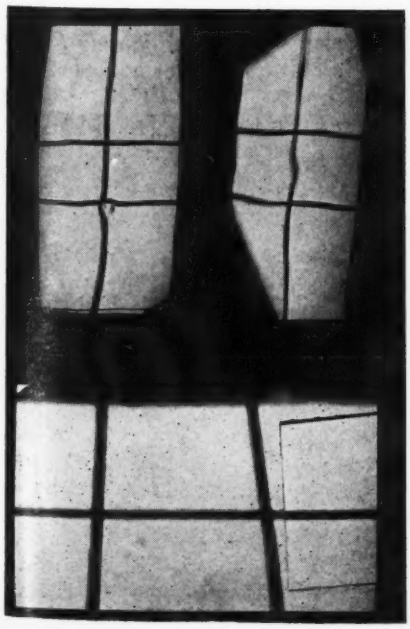
INSPECTION of various types of materials calls for a lighting application that is appropriate to the peculiar qualities to be detected by inspectors. No one prescription fits all cases. On this page are shown a variety of inspection lighting applications, each one different, yet each logical for the job to be done. The three pictures at right and just below carry their own description. Those at the bottom of the page, left to right, are more special. Small dents and dings in flat polished surfaces, irregularities of contour, such as occur in any flat glossy surface, can be detected by the wavy appearance of the straight black lines reflected in them from luminous panels. Transparent materials, such as clear plastics (at bottom), viewed against luminous panels with lines, show scratches or distortions plainly. In the center is shown a method devised by an inner tube factory to inspect for leaks. Air bubbles are illuminated by underwater illumination. Diffused light may be undesirable for inspecting unfinished wood slats as the lower ones show, whereas directional light on the upper pair reveals grain, rough edges, dents, or oil in the grain

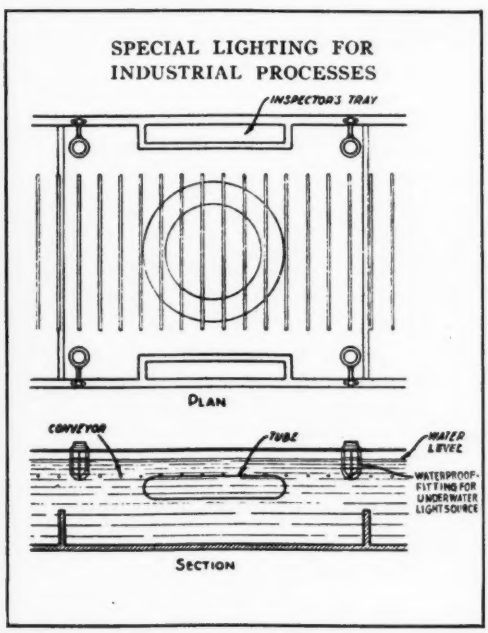
Directional light from large artificial windows at Simonds Steel & Saw Co. shows up irregularities when a steel flat is placed on a saw and directional light shows under it

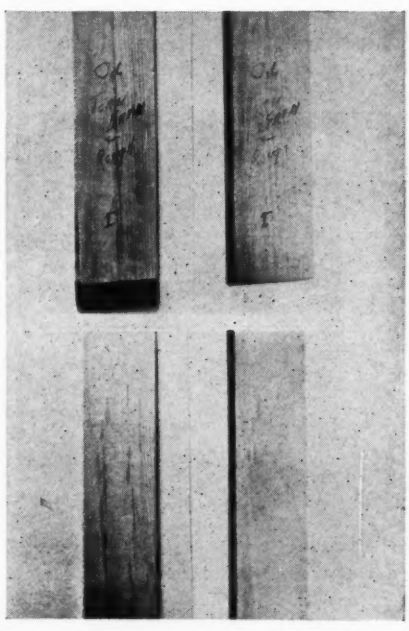
For inspecting small metal parts diffused light reflected from a large hood with 500-watt filaments in indirect RLM fixtures on 5-ft. spacing strikes parts from all angles



Chatter marks on the broached bearing (above) show up in distorted reflection of the spiral from the low brightness luminous area used to inspect polished curved surfaces







this equipment. Incidentally this RF equipment is no longer available for new installations. Use of a white cement floor contributes to the visibility on the underneath side of wings and fuselages.

Many lighting bottlenecks in the form of glare and shadows are prevalent in drafting rooms. In this highly important phase of war producton the familiar industrial unit designed by lighting engineers for industrial areas has been used quite extensively for drafting rooms because of its ready availability; and in many instances used incorrectly, for the lighting problem differs considerably.

One installation acclaimed by all who have seen it and worked under it as ideal is that in the Commonwealth Edison Co. drafting room in Chicago. The ceiling is entirely luminous. Reflector troughs are set into the ceiling on one face of a saw-tooth and the other side is covered with accoustical material. The luminous glass panels are not in the field of view of the draughtsmen. If the draftsman looks up he sees only the accoustical material; average illumination, 85 f-c.

Lighting for Inspection

Light has helped to solve many perplexing inspection problems. Inspection is a non-productive operation at best, and often results in more lost man-hours and critical material waste than any other single factor in production. Light has been adapted to a number of inspection processes and where so used has reduced spoilage and salvaged many man-hours. A few such applications are illustrated here.

Other inspection methods finding wide use in speeding up production and improving quality of product:

1. Black light for the detection of variations in oils, liquids, and other materials that fluoresce under near ultraviolet radiation. Also used to detect capillary flaws in non-ferrous metals.

2. Stroboscopic light stops or slows apparent speed of rotating, reciprocating and latching mechanisms to determine what happens under full load and speed.

3. Polarized light to detect strains in clear transmitting materials such as glass, plastics, etc.

4. X-ray and fluoroscope to detect the presence of metal in rubber, for inspecting castings and metal parts for flaws.

A factor often receiving too little consideration in a plant which is fairly well lighted is that of providing supplementary illumination at the work areas. In plants where continuous row lighting is employed, the illumination on lathes, milling machines, etc., arranged in symmetrical rows, is supplied by a multiplicity of light sources. This eliminates severe shadows; supplementary lighting may not be needed.

An example of the excellent visibility obtained on micrometer dials and other polished cylindrical surfaces illuminated by continuous row fluorescent lighting systems is shown in the illustration on the first page of this article. The slight dark spaces on the dial are caused by the gaps between the reflectors in this installation but even in these darker areas, visibility is excellent. It is especially important that the continuous rows be perpendicular to the axis of these surfaces.

In some operations, supplementary lighting in addition to good general illumination is the only answer, where visibility and comfort are extremely necessary because of the severe visual effort expended in some manufacturing operations. Another installation illustrated shows an average illumination of 50 f-c. supplied by the general lighting system, and 250 f-c. at the working area with one 30-watt 36-in. lamp per operator.

Women deftly operate reel winding machines, in another illustration, so that the tape lies smoothly on the reels. Their work is made easier and more certain by the 180 f-c. supplied from the supplementary fluorescent light consisting of two 20-watt lamps in shielding reflectors.

When determining whether supplementary lighting is required or not a general impression gained by looking at the plant interior from some vantage point is often misleading. The necessity for additional lighting can best be ascertained by taking the position of the war worker and following through the operations which he must perform at the point where he performs them. This procedure becomes obvious when we examine the lighting problems in some of our huge plants producing large aircraft. The enormous size of aircraft wings and fuselages makes seeing difficult underneath or inside these sections, particularly as assembly nears completion. White floors are a great aid in these instances. In the interiors as well as underwing surfaces, low brightness sources, such as supplementary fluorescent lamps, are not only an aid, but a necessity for satisfactory assembly.

The cover picture and pictures on p. 49 are excellent examples of the increasing use of such sources. These particular units plug in end to end and contain two 40-watt lamps. They supply high levels of illumination in these huge interiors. Other equipments employing 30-, 20-, 15-, and 8-watt lamps are finding increased use.

Getting the right lighting in the right plant at the right time will help to shorten the war. To all production engineers, foremen, setup men, and other contributors to war material manufacture, this is our obligation.

One 30-watt F lamp per operator raises the general 50 f-c. illumination to 250 f-c at critical seeing areas on tables

Two 20-watt F lamps supplement general lighting at the reel winding machines to furnish 180 f-c. for critical seeing

Production Jigs Fluorescent Lighted

J. A. Murray
Douglas Aircraft Co.

JIGS, in the parlance of the aircraft industry, are those frames or structures made especially to hold the framework of a wing section or a part of an airplane while it is in the process of being fabricated. Some jigs are stationary, whole groups of workers engaged around them in the assembly of one particular part for a large plane. Others are on conveyor systems which slowly move along. Most of them are at floor level and often work on or about them must be done in areas where the overhead lighting does not reach.

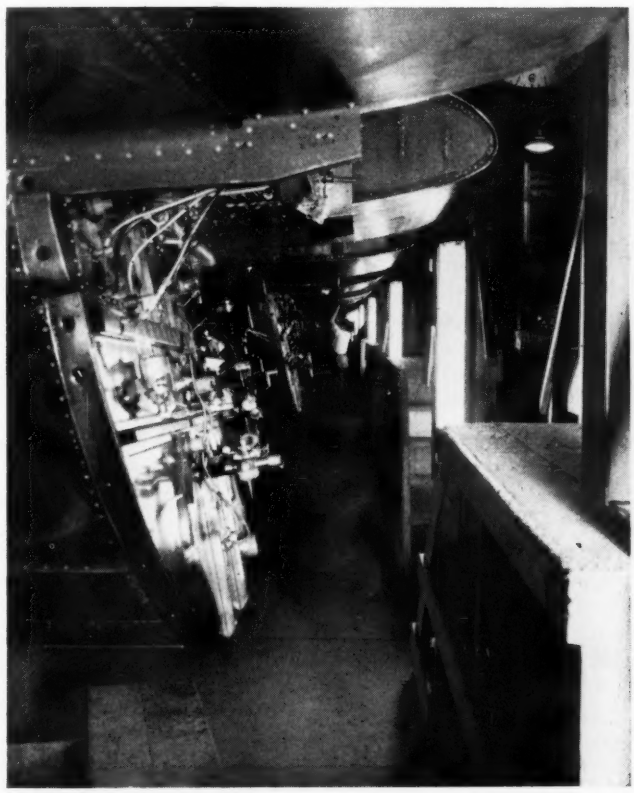
The problem of lighting jigs is one that cannot be solved by standard design methods for various reasons, several of which are:

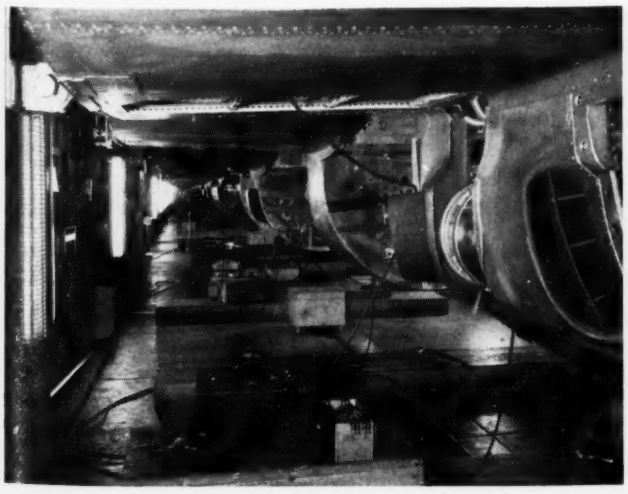
1. Available locations for mounting fixtures on jig members are seldom located where it is desired to place the fixtures.
2. The concentration of workmen requires the use of lighting that will not be obstructed.
3. In practically all instances, it is necessary to mount the fixtures at eye level height.

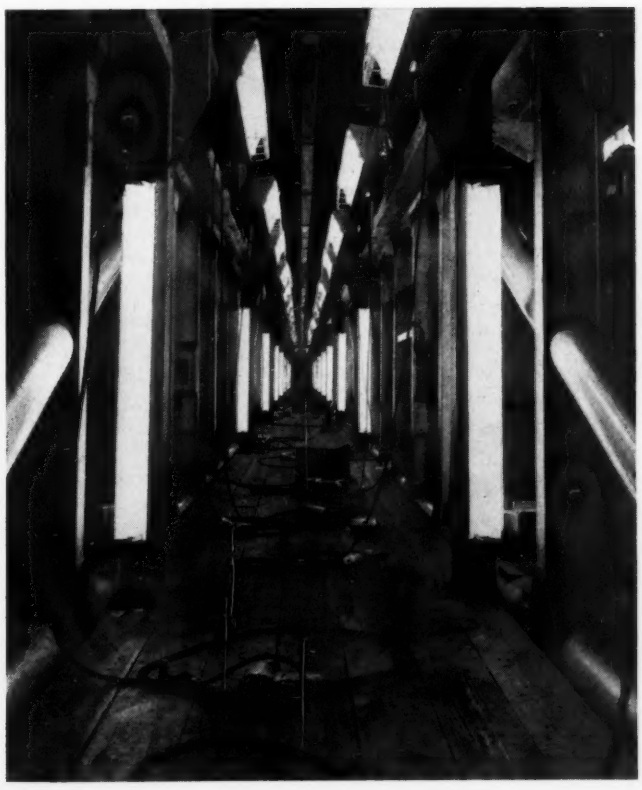
The use of the fluorescent fixture, although expensive for initial installation, is the best solution for lighting at eye level heights because of the characteristic low surface brightness of this type of lamp. Also the fact that the fluorescent lamp is a line source, rather than a point source, lessens the possibility of light being cut off when personnel are working in front of it. Santa Monica plant of Douglas Aircraft Co., after several experiments with different methods of lighting jigs, has standardized on fluorescent fixtures, using special elliptical reflectors. These fixtures are mounted on column and overhead structure members of the assembly lines and are spaced as closely as possible. Wire guards protecting the lamps are made of 1 x 3 in. mesh screen, to obtain a maximum transmission factor of the guard. Also, use of daylight lamps apparently has a psychological effect on personnel, because of the cool appearance of the light.

Personnel working in close groups required that maximum amount of fixtures be installed in order that sufficient light would fall on the working area.

Three general classifications of fixtures are used. One is the continuous single tube type; another is the standard 4 ft. two-tube fixture, the third type being a single tube fixture with remote ballast for mounting in small columns. These three types have found application in practically all cases where special fixtures are required.







A Lighting Design Check Chart

Robert L. Dearborn*
Kaiser Company, Inc., Oakland

HOW should the engineer proceed in the design of illumination for wartime industrial plants, big or small? What factors should he consider, what investigations should he make, what steps should he take and in approximately what order?

It was to clarify this for the writer's own use that the following outline of procedure, or check chart, was evolved. With such analysis of the needs and consideration of the physical and economic elements involved, the illumination engineer can proceed with reasonable assurance that his results will prove satisfactory within close limits. In these days when time is so limited, this outline may prove advantageous to follow.

I. General Basis for Design

It should be possible to justify any properly designed lighting system upon a realistic, practical basis. At least one of the following guides must be available to the designer as his starting point for any layout.

A. Officially approved standards based upon

(1) satisfactory general practices which have withstood the test of time,
(2) the judgments of qualified field observers, and
(3) scientifically conducted measurements and tests of the visual task and of methods to satisfy the actual requirements.

B. Application of the fundamental principles of illumination design in connection with a study of the visibility requirements.

C. Consultation with persons experienced in the operation of the plant or process.

D. Modification of the above due to limitations, restrictions and requirements of government orders and wartime emergencies.

II. Factors Involved in Design

An intimate knowledge of the process and operation is absolutely essential in order properly to design the lighting system for an industrial plant.

A. Visibility requirements as determined by the character of the visual task and the operation involved are:

(1) the size of the detail to be seen,
(2) the contrasts in reflection factors,
(3) average reflection factor,
(4) the time allowed for seeing, and
(5) color differences.

B. Ability to see is influenced by the various external conditions specifically

(1) average brightness of surroundings,
(2) average color of surroundings,
(3) size, brightness and location of bright areas within the field of view,
(4) brightness contrasts within the central field of view,
(5) brightness within the surrounding field, and
(6) pre-exposure of the eye to brighter or darker surroundings.

C. Operating procedure often modifies or limits the possible methods of providing illumination. Movements and positions of the operators and workmen introduce *shadow* and *glare* problems. Direct or reflected glare can and often does largely cancel the value of the level of illumination provided.

D. Physical limitations such as machinery and structural members influence both the quality of lighting and the type of lighting equipment that can be used.

E. Operating conditions such as accessibility, dust and water and frequency of use affect the choice of lighting equipment.

F. Economy of installation and operation of lighting equipment must be balanced against both the measureable and the intangible benefits of the illumination.

G. Visibility and the general success of an illumination system are usually as much affected by the painting of the surroundings as they are by the level of illumination.

H. War Department dimout regulations also modify the selection of lighting equipment but provision sometimes must be made for operation in peacetime while complying with wartime orders.

I. The levels of illumination and qualities of lighting are determined by the above factors. The level of illumination is not critical within a few percent. For example, there is no substantial difference between four and six foot-candles or between ten and 13 f-c., or between 20 and 30 f-c. in most cases. The other modifying factors are more important as influencing lighting design than is the absolute value of illumination.

III. Layout of Electrical System

The illuminaton design is by no means complete until the wiring and complete electrical distribution system supplying the lamps is also designed.

A. Electrical system cost sometimes is a strong factor in the selection of the type of lighting system and equipment.

B. Power system voltages must be utilized effectively.

C. The economics of load center locations, feeders, branch circuits and lighting unit control must be considered together with the economics of the light sources and lighting equipment in determining over-all economy.

D. Wartime restrictions and regulations are a challenge to engineering to produce the best results for the least cost and with minimum use of critical materials.

(1) Engineers must be qualified to produce the correct answers quickly.
(2) Lack of proper engineering experience and scientific investigation in previous years is now apparent.
(3) There is little time, if any, for research and detailed analysis now. But there are cases in which the end to be gained will amply justify the time required for more complete engineering study.

E. Streamlining of engineering technique in the preparation of electrical drawings to save time, duplication of effort and misunderstanding from the time of inception to completion of the construction is essential.

(1) Untold waste of man-hours and material on the job would be saved if the engineering designer would appreciate the importance of thoroughness and completeness in the preparation of drawings.

IV. Design Procedure

The following general procedure is being used in the design of the illumination system:

A. Organization of the work in accordance with plant construction schedules.

B. Study of mechanical and structural drawings and cooperation with those departments.

C. Conference with process engineers to establish fundamental requirements.

D. Determination of quality and quantity of illumination required.

E. Selection and location of lighting equipment.

F. Design of wiring and power distribution system.

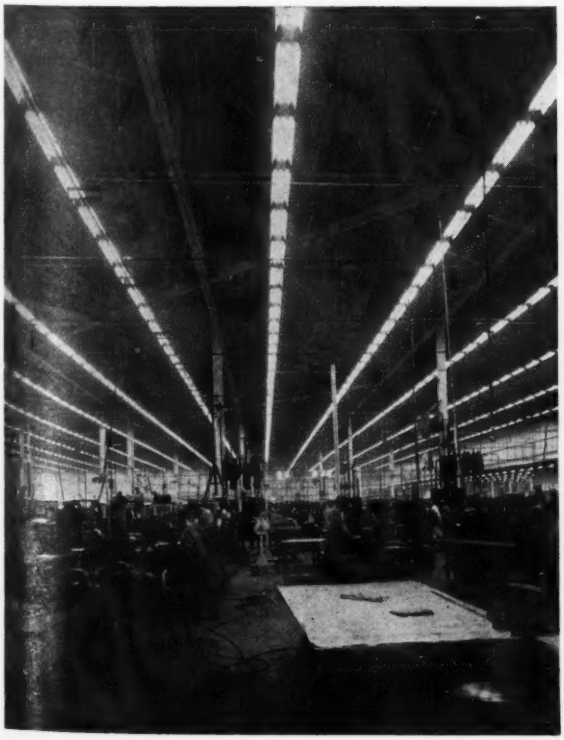
G. General study of economics, use of materials and re-design where necessary.

* Presented March 24, 1943, to Illuminating Engineering Society, San Francisco Bay Cities Section.

LIGHT Pours it on-

to speed ships, planes and war material for a blackout of the Axis

Examples of the way in which abundant light is aiding war production are shown on this page. Above, Marinship yard on San Francisco bay, works a swing shift with dimout controlled yard lighting. At right, Consolidated-Vultee in San Diego lights wing spray paint booths safely in this fashion. Below, North American Aviation at Inglewood works under continuous rows of fluorescent lamps, night and day. At the bottom, right hand corner, Sylvania furnishes a picture of a southern California war plant in which twin 40-watt F industrial type fixtures deliver high intensities of illumination for the fabricating of important parts for war machines. These are typical of war industries



Three Sources Used in Wartime Lighting

Incandescent, fluorescent and mercury each have their characteristic as well as economic and seeing advantages; where each should be used

D. P. Kohler
Lighting Specialist, Westinghouse Electric & Mfg. Co., Los Angeles

THE proper objective of contemporary industrial lighting is to give more and better light to industry for the least expenditure of labor and materials. Prior to war production operations, plant illumination was accorded little consideration. This fact has been substantiated by the emphasis placed upon war plant lighting revisions recently in all parts of the West.

Visual tasks encountered in war plants are the most critical of many found in commercial or industrial interiors today. These seeing tasks must be performed continuously over prolonged periods of time. Increased production requires illumination quality that will provide shadowless, glare-free light which tends to improve morale among wartime workers by enabling them to work with more speed and precision and without eye-strain.

Personnel managers find it increasingly necessary to employ craftsmen who are past the draft age. These men, most of whom are proficient and experienced in their work, are more subject to decreasing sight efficiency. This is indicated by scientific research, reports on which indicate that the pupil of the human eye contracts with age, reducing the amount of light that reaches the retina of the eye. Plant engineers, cooperating with employment offices, have found that more light must be provided at the working levels for post-draft age employees, than is necessary for younger men.

Three Sources—Where Used Best

Good lighting may be provided by incandescent, fluorescent, or high intensity mercury vapor lamps. Each of these three types of plant lighting has its specific basic applications, although numerous illumination problems have been overcome by using a combination of the three.

Incandescent lighting can be used for illumination levels up to 30 f-c. If higher levels are desired, wattage requirements are likely to be excessive. Increased wattage could make such an installation uneconomical, by generating an excessive kilowatt consumption.

Fluorescent lighting appears to be the most expressive of the lighting engineer's planning. Intensities can be built up to provide high levels of illumination, since this type of lamp produces more lumens per watt than incandescent. It is also true that fluorescent lamps illuminate with less glare and heat than other types available.

Engineered fluorescent lighting is found to be the most practical form of illumination for precision operations. It is particularly effective in drafting rooms, machine shops, inspection departments, tool rooms, and other departments where seeing tasks are precise.

Where seeing conditions demand high levels of illumination and high mounting heights are involved, *mercury lamps* should be considered. They are especially desirable in foundries, forge shops, steel mills, and large factory areas, where room proportions are excessive. Mercury lighting has characteristics that must be carefully controlled. Peculiarly different from other forms of lighting, mercury lamps will not allow distinct color definition because the output consists almost entirely of yellow and green light. Thus it is often desirable to use filament lamps in combination with mercury sources for color correction, to bring back red and orange tones into the over-all spectrum and permit more natural identification of color such as the appearance of the worker's skin and production material subjected to this illumination. The quantity, watt-

V for Victory is spelled in light too at the armament division, Hughes Aircraft Co., where 65 f-c. is furnished from 3-lamp, 40-watt F lamp Westinghouse masonite fixtures

Levels were raised from 25 f-c. to 40 f-c. in this aircraft parts factory in southern California when Newbery Electric replaced 300-watt incandescent with twin 100-watt F

age, and mounting specifications depend upon the individual lighting problem.

Drafting Rooms Are Critical

A major problem confronting plant engineers of war industries today is the proper illumination of drafting rooms. The varied reflecting surfaces, such as triangles, high gloss paper, and other tools of the draftsman's trade, create conditions that demand strict adherence to better lighting techniques. It may be assumed that the draftsman has one of the most critical jobs of war production today.

Incandescent lighting should be used in drafting rooms only with semi- or totally-indirect fixtures. With the advent of fluorescent lamps, having characteristics of high lumen efficiency and low surface brightness, it is possible to provide illumination levels of 50 to 75 f-c. comfortably and economically. One of the outstanding installations of this type is shown in the accompanying illustration where the Hughes Aircraft Company, Armament Division, drafting room installation provides 140 f-c. It is true that this illumination is exceedingly high, but it serves to illustrate the illumination potential of continuous strip fluorescent lighting. Even though the possibilities of fluorescent illumination as a light source are many, discrimination on the part of the lighting engineer is essential.

Semi-indirect fluorescent lighting has proved ideal for lighting drafting rooms where horizontal boards are used. A high level of well-diffused, glare-free illumination may be obtained with the installation of luminaires having clear ribbed glass bottoms in continuous strips parallel to the drawing boards. This mounting eliminates direct glare and annoying shadows by angle shielding of the lamps. Since light from this type of installation is diffused by the ceiling and the clear ribbed glass, mounted in a perpendicular plane, this results in very comfortable seeing conditions.

Surface Painting Important

Recent emphasis in plant illumination has been placed on the paint used to cover walls, ceilings and floors. The light reflection and absorption characteristics of various paints is the subject of continuous study by lighting engineers. They recommend careful consideration of three major factors—reflectivity, finish and color. It has been shown that coverage is an important factor, in that thin coats of paint have a much lower reflectivity than heavy coats. Recommended coverage is usually not more than 460 sq. ft. per gallon.

In most commercial and factory interiors the ceiling should be painted with a flat or egg shell white to provide a high reflection factor of 80% or more. Walls may be any light color with an eggshell surface that will provide 50 or 60% reflectivity. The flat or eggshell finish is usually desirable over glossy surfaces, as the latter will cause specular reflections from the light sources, and annoying glare will result.

Light ceilings are especially important where indirect installations are made, because the ceiling is a secondary reflector. In all types of lighting installations, the high reflection factor of white ceilings will increase the illumination, provide light diffusion, reduce shadows and in general, improve seeing comfort.

Usually mercury lighting is indicated for high bay manufacturing areas, such as seen at the rear of this Douglas Aircraft plant interior, but the production office in the foreground finds 55 f-c. comfortable to work under despite bluish color

Psychological Reasons

The chief benefits of light colored walls are the improved psychological advantages as well as the increase in illumination. Industrial relations department studies in war plants indicate that a worker should never be forced to look up into dark surroundings when he raises his eyes from his work. To do so may result in a detrimental effect upon his eyes, which may lead to eye fatigue. On aircraft assembly lines, much of the work is done with the employee looking towards the ceiling, hence both the diffused light of the fluorescent lamp, as well as free-from-contrast ceiling conditions, are necessary.

When a worker shifts his eyes from a bright to a dark area, his eyes must readapt themselves to the different intensity. The eyes accomplish this by two means; (1) the pupil becomes larger to let in more light, and (2) the retina becomes more sensitive to light. When the worker looks back to his work, his eyes must go through this procedure in reverse.

Further, light backgrounds and comfortable illumination will create a more cheerful atmosphere and increase the morale of the worker. Conversely, dark walls and surroundings will have an effect similar to that of a dark, gloomy day, and tend to create a depressive atmosphere. This can result in loss of production and increase in industrial accidents.

The color of the paint used may also tend to have a psychological effect on the employee group. In general, it is found that colors in the blue end of the spectrum tend to create a cool atmosphere, while colors in the red end of the spectrum create a warmer, more friendly atmosphere. Ivories and creams, frequently used, are classed as warm tones, but have been found to become tiresome. Red and oranges irritate, hence are believed to be a frequent cause of anger. The center of the spectrum—light blue-green or yellow-green—seems to be the most effective, both for the psychological and lighting factors.

Clean Lamps and Fixtures

The rate of decrease in light output of equipment installed in an industrial location varies with the type of installation and the amount of dirt and dust in the atmosphere. Many plants seem to overlook the importance of maintaining the engineered foot-candle efficiency. Such maintenance is usually only a problem of setting up a cleaning schedule, and providing for relamping.

Exceptionally high drafting room intensity of 140 f-c. is provided in this Hughes Aircraft Co. room in which industrial 3-lamp F fixtures are on 6-ft. spacings, 12 ft. high

Westinghouse's own drafting room at Emeryville, Calif., is given 60 f-c. levels from continuous strips of 40-watt F lamps in units on 3½-ft. centers on the 11-ft. ceiling

Proof that maintaining the light efficiency is necessary is shown in a case history of conditions in a department of an industrial plant in southern California. The plant hospital was asked to furnish weekly reports covering the number of employees complaining of headaches. One department had a particularly high average of hospital visits, justifying immediate investigation. The lighting layout consisted of 500-watt lamps in porcelain enamel reflectors, spaced on correct center and mounting heights, for a working illumination level of 35 f-c. Because of an accumulation of dirt on the fixtures and lamps, a light meter reading showed that an average level of only 7 f-c.—one-fifth of the rated output—was delivered by the dirty units. A washing crew went to work on the units with the result that the average working light level was increased to 32 f-c.

Save 367 Man-hours

Significance of this case study is shown in the hospital report for the following week. Only seven employees reported headaches, against 21 the previous week—a reduction of 66⅔ per cent. For the six weeks preceding the cleaning program, 149 persons reported headaches, and for the six weeks following, only 46. This represents an over-all reduction for the period of 69⅓ per cent. It was further discovered that in the preceding month, 576 dressings for minor injuries had been given in this department, whereas, the month following, only 312 were reported. Further, 367 man-hour units of production time were saved, which otherwise would have been wasted in walking to and from and waiting at the hospital.

Industry checks indicate that as a general rule, illumination drops to one-third of its initial value unless frequent, thorough washing of fixtures and lamps, and immediate replacement of burned out lamps, is made standard maintenance practice. The actual cleaning is best achieved by taking the reflector or glass down and washing it with a detergent and warm water at the floor level.

Group Lamp Replacement

Many companies are finding the group replacement plan a convenient method of relamping. The cleaning schedule is worked out so that the lamps are approaching the end of life at some even multiple of the period between cleanings. At that particular cleaning, which may be somewhere between 80 or 90% of normal lamp life, the entire installation is relamped, thus restoring the system to practically its initial efficiency. The old lamps are separated into two groups. In one of these, the lamps are so close to the end of life that they are of no further use; in the other, the lamps are used to replace the few early burnouts which will occur in the next period. Advantages of this plan are: (1) Fewer burnouts during working hours; (2) Decreased labor cost of lamp replacement: and (3) Restoration of the installation to essentially initial efficiency at definite intervals.

With fluorescent installations, the importance of relamping immediately when a lamp fails is emphasized. When a fluorescent lamp burns out, it will flash on and off. If this continuous flashing is permitted over a period of time, the starter may become defective, and the ballast equipment may be injured. Thus, in addition to a new lamp unit, both the starter and ballast may have to be replaced. Both use additional critical materials, and on the replacement and new installation schedule now in effect in the country's war plants, this careless cause of failure would add an additional burden on production and delivery of lighting equipment.

Other factors of wartime illumination problems are numerous, when considering major war plant lighting problems on an all-industry basis. For example, lighting manufacturers and plant engineers often suggest rugged, efficient equipment to withstand severe shock, vibration or welding splatter. Also, they may be called upon to provide illumination for special tasks in hard-to-reach spots of assembly or production line. But these specific cases are relative to individual plant conditions, and cannot be considered in general lighting practices.

The major qualifications of good lighting do apply to the three main phases discussed here, namely, adequate lighting for draftsmen, attention to the painting of walls, floors, and ceilings, and proper maintenance of lighting fixtures. Engineers report that the technical advances of the three forms of lighting discussed — high wattage incandescent, fluorescent, and high intensity mercury vapor—have contributed much to the production impetus that has made assembly lines of this country's factories the most efficient in allied war production.

● The Role of Lighting in Accident Prevention, a paper by H. L. Logan, managing engineer of the Controlens Division, Holophane Co., and presented to the AIEE, is available in pamphlet form. It treats with the relationship between lighting, visibility and accidents in industry and traffic.

Cold Cathode Produces Light Canopy

Large volume of low surface brightness fluorescent tubing lights aircraft office

George C. Greenlund and *Chet Miller*
Division Manager, Electrical Products Corp., Los Angeles
Industrial & Public Relations Dept., Douglas Aircraft Co.

CONSIDERATION of what might be called the human factor—the effect upon individuals required to work long and continuously under artificial illumination—was given by Douglas Aircraft Co., Inc., engineers in the adoption of Zeon continuous fluorescent tubing in a recent installation in one of its new office buildings.

Recent trends in lighting have been toward brighter lighting as expressed in terms of foot-candles on the working plane. This movement has increased rapidly with the longer working hours in war plants and the necessity for higher individual efficiency. Added impetus has been provided by the greatly improved luminous efficiency of fluorescent lamps. While eye-strain and resultant fatigue have been notably reduced under adequate lighting, it has been found that foot-candles alone are not a true measure of good vision and, in fact, that the higher light levels may be detrimental if accompanied by glare or unfavorable contrast ratios.

It is now well established that the amount of light required for good vision is entirely relative to surrounding conditions. The average individual can actually see quite clearly where the foot-candles are not measurable after the eyes have become adjusted to the low level provided that there are no other lights in view. Night drivers under dimout conditions are now familiar with the odd fact that when their headlights are dimmed they can still see with ease on a starlit night where there are no opposing headlights.

The same principle may be applied in light engineering for the human element in the factory or office. The higher the light level the sharper the contrasts and the more essential it becomes to consider this factor. While the ill effects of an exposed incandescent lamp are well known, they may still be found dangling in many a work shop today. This is the extreme case of improper lighting, which, as an illustration, would be made worse instead of better by simply increasing the lamp size to raise the general level.

The lower surface brightness of the fluorescent lamp is a great improvement in this regard, but as higher light levels are introduced it becomes more important to take all measures possible to avoid unfavorable contrast values. It is entirely a matter of degree. With the long, continuous hours of war work, whether in office or shop, any improvement in the lighting conditons is important, not only to the well-being of the individual, but to the war effort as well.

Intrinsically cold cathode fluorescent or Zeon is identical with the more familiar standard fluorescent lamps. The quality of the light is the same and the luminous efficiency is comparable. The essential difference is that cold cathode fluorescent is formed in long sections requiring higher voltage than the shorter standard lamps. In the Douglas installation the average tube is 17 ft. in length, several such sections being operated in series by 15,000-volt transformers of 60-milliampere current rating. Approximately four watts is consumed per foot of tubing. At such low wattage it is apparent that a large amount of tubing would be required. This footage could have been reduced proportionately by increasing the current, but this in turn would also have increased the present low surface brightness of the tube. It was considered preferable because of the human factor to use more tubing in order to provide maximum distribution of the light source at minimum unit brightness.

As a result there are no intervening dark spaces between the tubes. The ceiling which serves as a reflector is painted a flat white which reflects the light in such a manner that there is little apparent difference between the low surface brghtness of the tube, and the ceiling itself; the whole ceiling becomes one luminous element. On the working plane there is less than one foot-candle variation over the entire area which is as uniformly canopied with light as though it were from the open sky instead of a series of separate sources. There are no sharp contrasts, no deep shadows; in fact, a lead pencil in a vertical position will not cast a shadow on a piece of white paper. Under these favorable conditions, the 30 f-c. level is entirely adequate for close continuous work.

Because of the large amount of tubing required, and the fact that it is engineered and custom manufactured for the particular application, the first cost of Zeon is considerably higher than with standard lamps. However, the life expectancy of the tubes exceeds 15,000 hours, which recaptures in maintenance economies the difference in installation cost. The electrodes are of pure iron and of the cold cathode type, requiring no heating circuits or delayed starters.

Ceiling paint acts as reflector and brightness contrast is reduced throughout

Contrast Painting Aids Light

Third dimension effect at danger points on machine tools improves seeing and safety

WHOEVER started painting machinery and motors a battleship gray had an idea. It was to make the dirt and grease on them less visible.

Yet by slavishly following this lazy idea for years without queston, industry has cheated itself of a lot of dollars it has spent for illumination by making the work done on its machines less visible too. No doubt this painting habit has contributed to the accident rate, also, because dangerous moving parts of a machine were no more visible than the general surroundings, in fact actually camouflaged by them.

A new idea in painting has emerged. Like all great ideas, the simplicity of it—to paint for contrast—is such that it is to be wondered why it was so long being discovered. Its fundamental principles were always true.

Perhaps it took a war with its insistence upon absolute economy in the use of materials and the conservation of electrical energy to bring this idea into immediate focus. Now attractively titled "Three Dimensional Seeing," the idea was first presented in a paper before the 35th annual convention of the Illuminating Engineering Society at Atlanta, Ga., in September, 1941, by Arthur A. Brainerd and Matt Denning, director, Lighting Service, Philadelphia Electric Co., and director of trade sales, finishes division, E. I. duPont deNemours Co., respectively. It was titled "Improved Vision in Machine Tool Operation by Color Contrast," and represented the result of some 3 or 4 years of research work. (Illuminating Engineering, Dec. 1941, p. 1397).

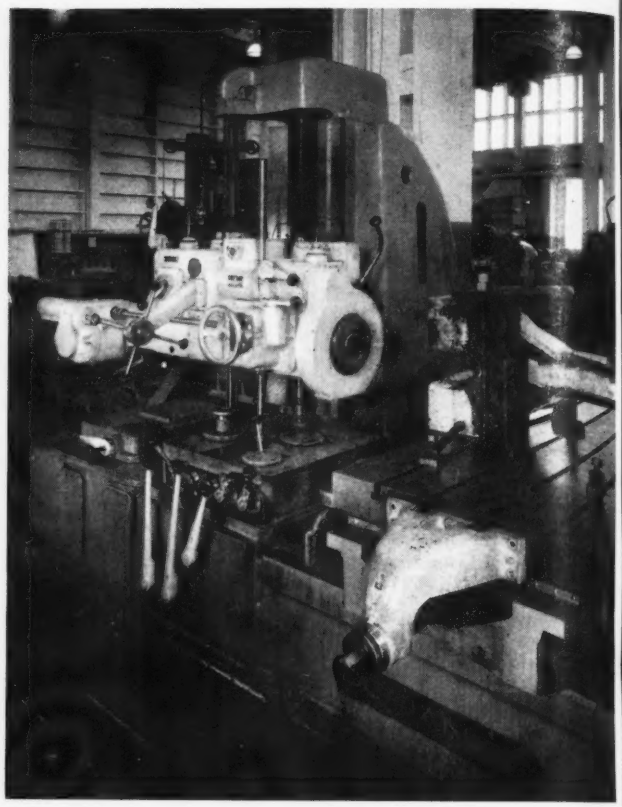
Conclusions reached from this experimentation with the painting of machine tools in contrasting tones and in contrasting colors are summed up in these statements.

"First, soft contrasts are easier on the eyes than abrupt changes in brightness.

"Secondly, making the tool area slightly lighter does tend to concentrate the attention on the work.

"Thirdly, a favorite contrast, as in the band saw, does highlight danger.

"To those of us most closely connected with the investigation, and to various engineers who have been consulted, the most significant feature is the three dimensional effect secured by controlled color contrast. The work in machines so treated stands out in stereoscopic clearness that cannot be achieved with brightness contrast alone."



Area around tool head and end of moving table on horizontal miller painted in light buff emphasizes danger zones in contrast to grey surroundings

To translate this basic study into its simplest, most practical, usable form for application to any machine, the following directions are almost universal: Instead of the all too familiar dark battleship gray, the machine itself may be painted a medium gray, (reflection factor from 30 to 50%). The working areas or the danger zones should be painted a buff, (reflection factor 50%).

In these experiments duPont company tried light blue, aluminum, yellow, light gray, light green, buff and medium gray and now recommends its "horizon gray" and "spotlight buff" where work is being done on dark or shining metals, such as iron, steel, nickel, chromium, etc. For color contrast a "spotlight" green is recommended where the material is brass, bronze or of such color as to be in contrast. The buff and gray not only give the better reflection factors but under time tests for either mercury, fluorescent and incandescent lighting proved best.

It was found that the old battleship gray in effeect was like camouflage in that, being of the same or nearly the same tone as the metal being worked upon, it presented a difficult seeing task to discriminate between the machine itself and the material. In zones where cutting tools, band saws, shears and other hazards exist, the desirability of having such moving and dangerous tools in sharp contrast to their surroundings is obvious.

With more severe restrictions placed on installation of lighting equipment and a virtual ceiling on the total foot-candle intensity permitted this painting procedure offers an opportunity to make more complete utilization of the existing illumination to derive the maximum seeing from it. Further utilization of the light flux can be stepped up by painting of the complete surroundings in paints of higher reflection factors than normally have been the custom. Light emitted from a source is absorbed in the darker colors but bounces from surface to surface of higher reflection factors in such a way that both diffusion and full utilization of the flux is achieved.

A psychological factor, too, enters. In surroundings of generally light colors a more cheerful atmosphere prevails. Moreover the difficult problem of housekeeping is alleviated by a natural pride in maintaining the clean, light surroundings. Absence of severe dark-to-light area contrasts in the surrounding room area relieves the eye muscles of necessary pupil adjustment and reduces the amount of energy consumed in seeing.

An excellent example of the impetus which has been given to the three dimensional painting in conjunction with a fine lighting installation is that at United Engineering Co., Ltd., San Francisco, pictured here, where high bay units have their light reflected from a light colored ceiling and walls where the machines are being repainted.

Training Vital

Utilization personnel should be prepared

TRAINING is still necessary. Despite dimout and a curtailment of kilowatt-hour sales for the duration, training is still necessary to prepare utilization personnel for their jobs advising and assisting customers to utilize their electric service to its highest efficiency.

So feels Ted Bakeman, of Puget Sound Power & Light, manager of commercial and industrial utilization. Many of the specialized personnel have been lost to the war and men formerly on competitive commercial contract work are being trained as lighting, power and heating representatives. Their work will be principally among industrial and commercial customers on service and maintenance only.

There are six or eight of these general utility service consultants assigned by territory or by customers in certain areas.

First training program has been on lighting. Their work calls for periodic and frequent calls upon customers to confer with them upon utilization in general as well as rates, service, complaints.

"When you come right down to it," said Bakeman, "our work is a pure utilization service. We must always help our customers convert the raw kilowatt-hours into useful service such as seeing ability, relief from eye strain, critical inspection aids, etc. There is nothing absolute in the way these kilowatt-hours can be used. A great flexibility in the manner of use and in the efficiency of utilization is always there and our men can help customers to design their uses for greater efficiency."

These men are trained to handle run-of-the-mill problems and recognize those which call for a specialist. They are backed up by specialists not only in the lighting, but on heating and power and on heavy duty commercial cooking.

The school is unique in its handling. Previous methods used to call for three to five days of intensive schooling. Bakeman feels that perhaps this was too intensive and made it difficult for the men to absorb the full knowledge. The new technique calls for 13 or 14 sessions of two hours each three times a week from 8:30 to 10:30 mornings on Mondays, Wednesdays and Fridays. It consists of lectures, question and answer conferences and, between sessions, a field assignment. With the first lecture on visual tasks, for example, the men were assigned to pick out a regular customer and analyze the factors brought forth in the lecture related to visual tasks and to make a report to the next class upon them. They were asked to note the various science of seeing factors in evidence in workmanship and in the operation by employees. Such things as blinking, scowling, shading of eyes, etc., were to be reported.

In addition, discussion of papers was held and seminar conferences with an experienced man. For example, a certain lighting design problem is taken and discussion ensues on what has been done, what could be done and what could be done better. Then a lighting survey is made in the company of an experienced man. Thus, lecture, discussion, conference and seminar are supplemented by field work both by themselves and with experienced men accompanying them.

Sixteen men in all were taking this class work, many not yet assigned to such work but coming from other departments to get the training. All of them were from the Seattle division. Later a week of conferences may be held twice a year as refresher courses for the division personnel.

Since lighting is the one service that all customers use, the first field for training was in lighting. Later it is planned to have similar training on heating and power. Instructors are Paul Marble, Al Couch and Ted Bakeman. Gail Blanchard, a power specialist, was also drafted for the course, as was George Rideout, who talked on training and personnel work. The instructors handle related subjects and work together at each class. No less than three are on each class program in order to provide diversity, not only in personalities but in means of expressing the information. The final session, it is planned, will be one in which the group will be taken to major equipment distribution points to acquaint them with the availability of equipment in the territory.

● PUBLICATION OF A LIGHTING HANDBOOK, preparation of a moving picture, and employment of a technical secretary are on the program for the Illuminating Engineering Society, based on recommendations presented by the society's committee on postwar planning. The technical secretary will be added to the staff and serve under the executive secretary at society headquarters. In general, he will be engaged in stimulating technical and research projects. The handbook is to include solutions of specific problems in industrial and commercial lighting as well as contain general principles of design and methods of calculation. It will be supervised by a handbook publication committee headed by S. B. Williams, editor of *Electrical World*. The moving picture is planned as an educational medium for improving lighting conditions in wartime industrial applications.

School Lighting

School lighting at least can proceed intelligently whenever it is possible to use critical materials in the lighting of schools again. In California this is provided for by a three-part program which will reach school officials, teachers, boards of education, and architects.

A revised and new edition of *Recommended Practices for Lighting California Schools* has just been prepared by the research committee of the Sight Conservation Council of Northern California for the California State Department of Education, Division of Schoolhouse Planning, at Sacramento, as the first part of that program.

This 19-page mimeographed bulletin has been published by the state. It is the work of the council's research committee, consisting of Clark Baker, lighting counselor, Northern California Electrical Bureau; Charles Bursch, Ph.D., Chief, Division of Schoolhouse Planning, California State Department of Education; John Lyon Reid, A.I.A., Ernest J. Kump Co. and Leland H. Brown, Ph.D., chairman of the committee, associate professor of electrical engineering, Stanford University. Dr. R. S. French, president of the Sight Conservation Council and principal of California School for the Blind, Berkeley, was its editor.

The second part of the program will be to make a field test of its acceptance and understandability, together with visual demonstrations of the major factors contained in the bulletin before selected audiences of school trustees, school business managements, school supervisors and school nurses. Several county school boards will be given an opportunity first to read the bulletin, then be questioned as to their understanding of its technical material and then offered demonstrations to clear up any questions as to the application of the principles outlined therein.

This will be preliminary to a broader educational program following the war, which will carry the same demonstrations and information to the entire school system.

The project is a cooperative one which is receiving voluntary support from the council, school officials and the State Department of Education in order that it may be carried on for the benefit of the children of the state whose education will be influenced, aided or retarded by the lighting conditions in school premises.

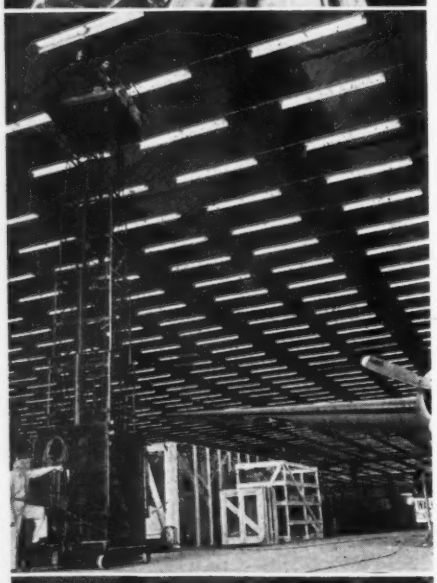
Electrical West—Vol. 91, No. 3

EMEA *Dope Sheet*

Maintain Plant Lighting Efficiency

What price good equipment unless it is kept clean? Soap and water, not mere dusting, restores original light output

Photos from Westinghouse



1. Regularity pays. Dirt, dust and grease, studies show, reduce lighting efficiency as much as 35% a month. A study in Cincinnati indicated an average cost of cleaning per fixture of 20 cents. With a 35% depreciation per month, it estimated the most economical cleaning interval to be every 22 days. Such costs may differ in other plants but the relationship is close. It pays to clean equipment on a regular schedule—possibly during the swing shift or graveyard shift or on Sunday.

2. Thoroughness pays. The difference between a good soap and water cleaning and a wiping off of dust is as much as 20% of light output. The cost of the washing job will not be enough higher to balance the loss in light.

3. Equipment pays. Valuable time is wasted in makeshift maintenance. Good ladders for safety, scaffolds, bridges, catwalks for access to lighting may seem costly but they pay in time saved and in reduction of accidents. Safe, sturdy equipment is necessary for access to the lamps.

4. Soap and water with a good alkaline detergent like tri-sodium phosphate, will cut grease. It can be used on porcelain enameled or glass equipment or in weak solution on painted surfaces of pressed composition reflectors, but *DON'T* use it on aluminum. Use an Alzac cleaner on aluminum.

5. Two-man teams sometimes do the job quicker and hence interfere with production less. One man on the ladder removes lamps and dismantles reflectors and hands them down to the man on the ground, taking the previously cleaned reflectors and lamps from the latter and putting them up while the man on the ground washes those taken down.

6. Moving the ladder to the next unit, the process is repeated. The man on the ladder has a pocketful of starters, tests the lamps and sees that the unit operates.

7. Group replacement may pay when all costs are considered. With about the same life expectancy, lamps should burn about the same length of time if voltage is uniform. If replaced at about 80% of their rated life, 20% may have failed and the balance have delivered 83% of their light.

8. Sorting of lamps taken down, those nearly through can be eliminated and those still good can be used to refill sockets of those which fail between group relamping.

9. Mercury lamps, costing more and having indefinitely longer life, cannot well be group replaced. The plan works best for filament and fluorescent lamps.

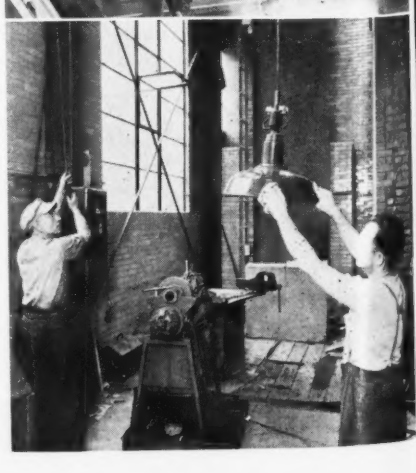
10. If lamp life is short it may be caused by overvoltage, temperature, or mechanical hazards. Check all three.

11. Trouble shooting on fluorescent lamps is simple if directions found in the following pamphlets are followed.

"How to Maintain Lighting," General Electric Co.

"Fluorescent Service and Maintenance," Westinghouse.

"Timely Tips on Fluorescent Maintenance," Sylvania.



Priorities

Fewer regulations issued last month

TYPE RW wire is done for the duration. Fluorescent lighting fixtures are under tighter restrictions. Poles are under a specific price ceiling. Stove rationing finally goes into effect. Such were the top items of a quiet month in regulations and price controls affecting this industry. Probably nearly everything else is in the groove by now and further restraints are likely to be only to smooth out remaining burrs.

● *Type RW* (NE Code) insulation for building wire takes considerable new rubber. To conserve remaining stocks for war needs no more RW wire will be made. Its special virtue, that it could be used underground and in wet locations without lead, will have to be supplied by a return to lead covering of cables, Underwriters' Laboratories say, because acceptable properties and performances of new insulating compounds have not been established.

● *Fluorescent lighting fixtures* were rationed still less metal by an amendment to L-78, Aug. 18. It did permit manufacture until Dec. 1, 1943, of fixtures for offices and drafting rooms, termed non-industrial, because inventories of these are nearly exhausted. Manufacture of some industrial types is stopped and weight limitations are extended to all permissible types. Only portables, hazardous location fixtures, and shipboard fixtures are exempted from the metal limitations. Other details restrict sales between manufacturers and distributors, retailers sales of inventory and delivery for storage.

● *Airport lighting equipment* to equip more fields with low visibility, high intensity landing area lighting was discussed by the Airport Lighting Equipment Industry advisory committee of WPB, of which H. S. Kimball, managing director of Lights, Inc., Los Angeles, is a member from the West. Cooperative design efforts will make available "snow country contact lights" for many airports this fall.

● *Repairs* were given further assistance by amendments and directions. Blanket preference ratings were assigned for repair and maintenance to be applied by persons eligible to use them to repair machinery and equipment, even if the repair job does not involve delivery of repair parts or materials. (PR-3, amended Aug. 10.)

● *Farm machinery* repairs were likewise given aid by an amendment to PR-19, Aug. 12.

● *Welding rod* for repair shops is made available in small quantities under assignment of an AA-2 to them by Direction 10 to CMP-5, July 28. Any shop may purchase up to $15 worth regardless of previous use, and up to $100 worth if more was used a previous month.

● *Western poles* and piling were given specific maximum prices by OPA, under Amendment 1 to Revised MPR 284 (Western primary forest products) effective Aug. 3. Previously GMPR covered, but new prices for piling are set lower than Mar. 1, 1942, while poles remain the same. Basic prices for Western red cedar and clean peeled Douglas fir are given untreated, with maximums for various types of treating. Prices are f.o.b. cars at the loading point in California and parts of Oregon, Washington and Canada west of the Cascades.

● *Stove rationing*—except for electric stoves—became effective Aug. 24, according to OPA. Dealers may obtain information, registration forms to obtain their licenses to sell and their inventory ceiling and other particulars from OPA or local rationing boards.

● *Table and floor lamps,* OPA warned, must not be hiked in price by subterfuges. The warning was issued to manufacturers, jobbers and retailers. Minor changes in design, changes in price differentials, sales by jobbers who never sold lamps before and thus established their own prices, were among the abuses warned against. Lamps come under MPR-188 as well as GMPR.

● *Assembled radios,* too, OPA warned dealers, must not be sold without tags attached by the assembler to indicate the officially sanctioned retail ceiling price for each item. Any assembled sets purchased before July 25 and without tags are to be held in stock until OPA and the assembler can provide proper tags and labels. This order, MPR-430, went into effect July 26. Labels inside the cabinet must show circuit diagram, tubes, manufacturer's model number and name, assembler's name and address and his stock number. This information is required to be furnished the purchaser on his sales slip, as well as guarantee, price and his own name and address.

● *Construction materials* are now governed by CMP-6, but what can and cannot be built comes under L-41. Electrical contractors, under CMP-6, are classed as "secondary consumers" and obtain their materials by an allotment number assigned to the prime consumer for which the building is to be done. Preference ratings are assigned the project and the contractor obtains his materials under these. Supply of critical metals, Donald Nelson announced, is still less than the need.

● *Pacific Northwest Region* has been set up to decentralize and expedite the war agencies. George K. Comstock, president of Electrical Products Consolidated, and vice-president of Pacific Huts, Inc., and a past president of Seattle Chamber of Commerce, has been made regional director, with headquarters in Seattle.

Dimout and Display

Dimout regulations in effect on the Pacific Coast have developed a new technique in window display and window lighting. This method is briefly outlined by W. E. Parnum, display manager for B. C. Electric Railway Co., Vancouver, as follows:

"Many merchants during present dimout restrictions are learning to use more color-lighting in window displays, which not only enables them to conform to regulations, but also to experiment with the use of color to add interest to many types of window advertising — especially when windows are deep enough to allow the use of concentrated white spotlights to highlight items of interest on display.

"Taking our B. C. Electric Granville Street store as an example, we have achieved a colorful solution to the dimout rules, through the cooperation of our lighting engineers.

"*In the Daytime*—All overhead window lighting is switched on, together with colored spotlights to keep our window displays bright and colorful. Also it is to reduce daytime reflections, especially on sunny days, when windows produce mirror-like reflections which mar so many displays that do not have sufficient lighting.

"*In the Evenings*—Our main overhead lighting is switched off and we use three reflector type spotlights in each window, capped with various color lenses to obtain dramatic lighting effects and at the same time, reduce the overflow of light on sidewalk areas to within the required one foot-candle.

"There are other ways of achieving these results, but after much experiment this was found to be the most effective. Local merchants are invited to call upon our lighting staff, who gladly offer advice on special window lighting problems."

Dutch Flat Designed As Fully Automatic

Factory assemblies are used to cut labor costs in 27,500 kva., PG and E hydro plant. Governor, switchboard and 11-kv. bus are completely enclosed. Stator shipped in one piece

T. J. Corwin and D. P. Dinapoli

PG and E, San Francisco

LATEST of hydro plants to go into operation on the system of the Pacific Gas and Electric Co. is Dutch Flat, adding 27,500 kva. in hydro generating capacity to the 894,700 kva. already in operation on this vast system. The plant was designed for full automatic operation in line with the company's policy of making all of the newer and smaller hydro plants automatic. For the present, however, the plant is being operated only semi-automatically.

Provision has been made so that in the future the unit can be readily adapted for complete automatic starting. Also, provision has been made to add a selsyn controlled load limit to the governor and the present float control in the tailrace so that the load on the unit can be determined automatically by the amount of water being used by a future plant to be built downstream from Dutch Flat.

The power house is located on the Bear River in Placer County. Development of the watershed from which the plant derives its water was started in 1913, when the first units at Drum power house were placed in service. Next followed Halsey in 1916; Spaulding No. 1 and Wise in 1917, and Spaulding No. 3 in 1929. This latter is a fully automatic plant of 7,000 kva. capacity.

Dutch Flat utilizes about half of the drop between Drum and the Bear River head dam which is the diversion for the Halsey plant. The final plant in the project will be Colfax which will utilize the remaining drop and bring the development to its ultimate capacity of about 150,000 kva.

Diversion for Dutch Flat plant is made some five miles upstream from the power house at an afterbay reservoir just below Drum power house. A 96-ft. dam was built here in 1924, for the purpose of regulating the flow below Drum power house. With a 26-ft. range in the water surface at the intake, 200 acre-ft. of storage is available for Dutch Flat. Maximum diversion is 475 cfs. The elevation of the tunnel invert at the intake structure was established to take advantage of this storage and still be high enough to permit the normal discharge to flow through the sluice gates at the dam without the water surface rising to a point where it would flow into the tunnel.

Intake and Tunnel

The trash rack bars in the intake structure cover a large area in order to insure a low velocity of flow through the bars. They are serviced with two automatic trash rakes operating on an endless chain. The number of rake bars and the speed of travel is such that the entire surface is raked clean in about one minute of continuous operation. These rakes are float controlled and operate automatically only when enough debris collects to cause a small increase in the loss of head through the bars. A momentary contact is provided for manual operation.

A tunnel 21,600 ft. in length conveys the water from the intake to the surge chamber above the power house. The rough excavation approximated a 12-ft. horseshoe section. In general the upper and lower ends of the tunnel were driven through slate formation and did not require concrete lining. About 13,000 ft. was through serpentine. Timber sets and lagging were required in this formation and in many places the framing was distorted due to swelling of the serpentine, apparently caused by air slacking. This action was retarded and in many places stopped by applying a thin layer of gunite on the exposed surfaces. Permanent concrete was placed throughout the serpentine formation.

Surge Chamber

The surge chamber was proportioned to permit the plant to pull up to full load in one minute or reject full load in four seconds. This required a differential type surge tank in order to keep its size within reasonable limits. Due to the topography at the site a non-spilling tank had many definite advantages. The tank has a total depth of 90 ft. and a maximum diameter of 34 ft. The lower 50 ft. of the tank was excavated in the form of an inverted truncated cone.

As the excavation of the tank progressed, circular gunite bands were placed to hold the formation. This method obviated the use of timber braces and simplified construction problems. Since about one-third of the tunnel is unlined, a sand trap was placed directly under the tunnel at the lower end. It is about 100 ft. long and consists of a series of ports which will trap material moving along the invert of the tunnel. Flow through the sluice is controlled by a 34-in. butterfly valve.

The penstock is 3,640 ft. in length and varies in diameter from 96 in. to

Dutch Flat operates under a head of 596 ft. with a single semi-automatic, 27,500-kva. generator. Only one plant remains to complete Bear River project

At right: single line wiring diagram

78 in., and in plate thickness from 3/8 in. to 1 in. The pipe was fabricated from firebox steel with longitudinal and circumferential joints welded automatically with a shielded arc. Each weld was radiographed except for plates under one-half inch. All sections were stress relieved in a furnace. Circumferential field joints were riveted, the rivets being counter-sunk on the inside and with a single butt plate on the outside.

Spun enamel lining was placed in each section of pipe in the shop. This spun enamel finish has the appearance of a waxed linoleum and the penstock as a whole had a very smooth bore.

Ten expansion joints with inserts of nickel-clad steel were required. At the suggestion of the manufacturer these joints were assembled and packed in the shop. This method proved to be superior to former practice of assembling joints in the field. Five groups of air valves were placed at critical points along the line. A 96-in. hydraulically operated butterfly valve located at the head of the penstock can be closed by remote control from the power house, but can be opened only by controls at the valve. Automatic features may be added at some later date so that the valve will be self-closing in case of penstock failure.

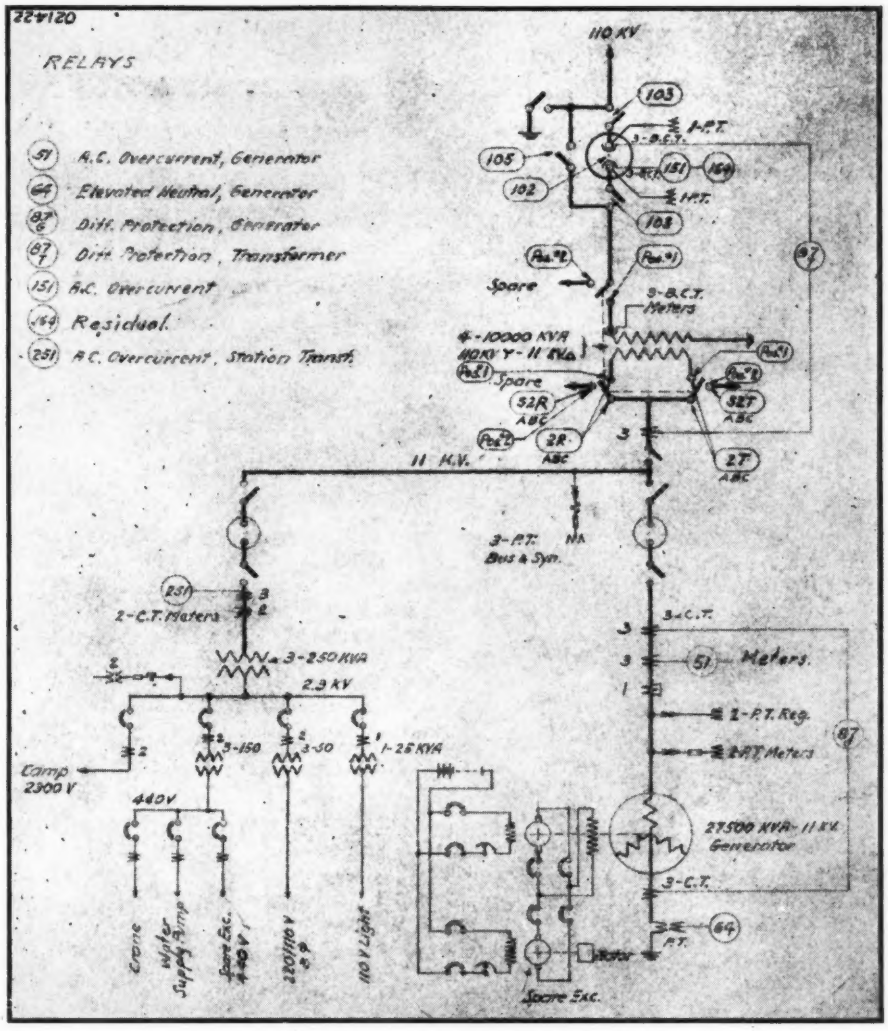
Power House

The single 29,000-hp., vertical Francis reaction turbine operates under a net effective head of 596 ft. The generator is rated 27,500 kva., 0.8 P.F., 11,000 volts, 60 cycles, 400 rpm., and has a direct connected 250-volt exciter. Output of the machine is fed into the company's 110-kv. system through a bank of three 10,000-kva. transformers.

The turbine governor is of the oil pressure relay valve actuator type controlling the gate position through oil operated servomotors and is completely enclosed in a metal cabinet as shown in one of the accompanying photographs. This cabinet contains all essential auxiliary controls and instruments for the operation of the unit.

The governor oil pressure system is supplied by duplicate oil pumps, one electrically driven for normal use and the other driven by a small water wheel contained in the governor cabinet. The latter operates automatically in case the motor driven pump fails to produce sufficient pressure.

The main butterfly valve is 78 in. in diameter and is hydraulically operated. The valve is closed by pressure taken from the penstock side of the valve and opened by pressure from the scroll side. The turbine is equipped with a 100% relief valve. Two independently



driven oil pumps supply the turbine guide bearing. One is driven by an a-c motor and the other by a d-c motor, so controlled that the d-c motor automatically starts in the event of failure of the a-c motor. In event of total oil failure the unit will shut itself down and lock out. Oil is supplied to the bearing for about 30 minutes after the main butterfly valve is closed.

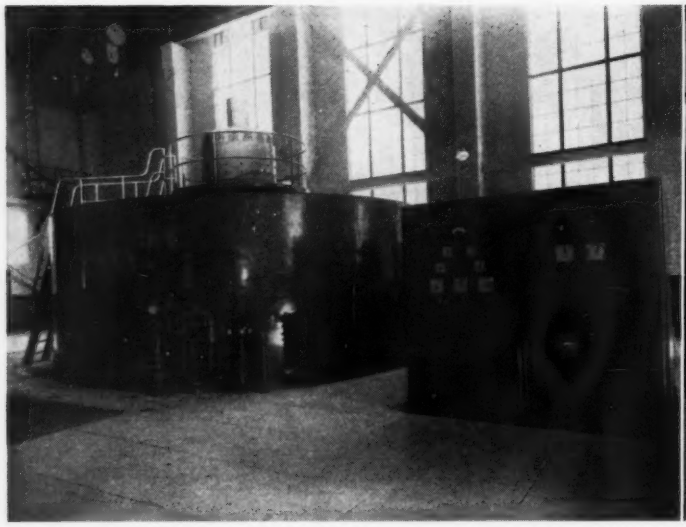
A mechanical overspeed device of the fly-ball type is provided in the housing immediately above the turbine bearing, which actuates the control valve to close the main butterfly valve. The setting of this overspeed device is higher than the setting of the electrical overspeed device in order that the latter will normally function first.

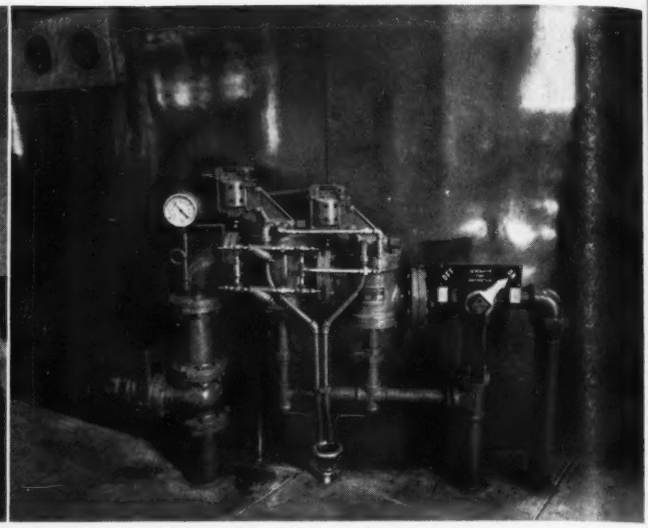
Generator

The generator has full class "B" insulation in both armature winding and field coils. Lower and upper guide bearings are self-lubricating, the latter being combined with the thrust bearing in the same lubricating oil reservoir. Water coils supplied from the same source as the air coolers of the generator are used to cool the bearing oil.

The stator was shop fabricated, wound and completely assembled at the factory and shipped in one piece, which is unusual for a stator of this size. This effected a considerable saving in field labor by eliminating the installation of joint coils and their connections at the site. Cooling water for the air coolers as well as for the generator bearing lubricating oil is supplied from the tailrace by three pumps, two for normal use and one as a spare. Air operated brakes are provided to stop the rotor and are so arranged that they serve as jacks for lifting the rotor off the thrust bearing to facilitate maintenance and inspection.

The generator is provided with a fire extinguisher manifold to which water can be applied to the windings from a water tank located above the power house. Water to the manifold is controlled by simultaneous operation of two solenoid operated valves in series. One is operated by the generator differential relays and the other by the opening of a thermostatic circuit. This circuit consists of 32 normally closed thermostats connected in series installed near the stator winding. The valves and piping are so arranged that when routine testing of the





automatic operation of these valves is done, the water is shut off from the generator manifold and open to drain into the tailrace.

Main generator showing enclosed governor cabinet, fire extinguisher valves and permanent magnet generator on extreme upper end of generator shaft. Automatically operated valves (right) supply water in event of generator fire

Switchgear and Bus

The 11-kv. switchgear, including two oil circuit breakers, disconnect switches and instrument transformers consists of factory built and assembled metal enclosed cubicles. The main leads from the generator to the switchgear and from the switchgear to the transformers, including the outdoor transfer disconnects, are metal enclosed bus runs, factory built and assembled.

This design eliminated cable connection, making a complete metal enclosed connection from the generator terminals to the low tension bushing throat of the main step-up transformer bank. These units were assembled in the factory in as large sections as could conveniently be handled in the field, thereby effecting considerable saving in installation costs.

Transformers

The main transformer bank consists of three 10,000-kva., 11-kv. to 110-kv. transformers connected delta-wye, with a fourth as a spare. Self-cooled rating of each is 7,500 kva. and self-cooled, with blowers, 10,000 kva. The transformers are mounted on rails with the usual transfer track.

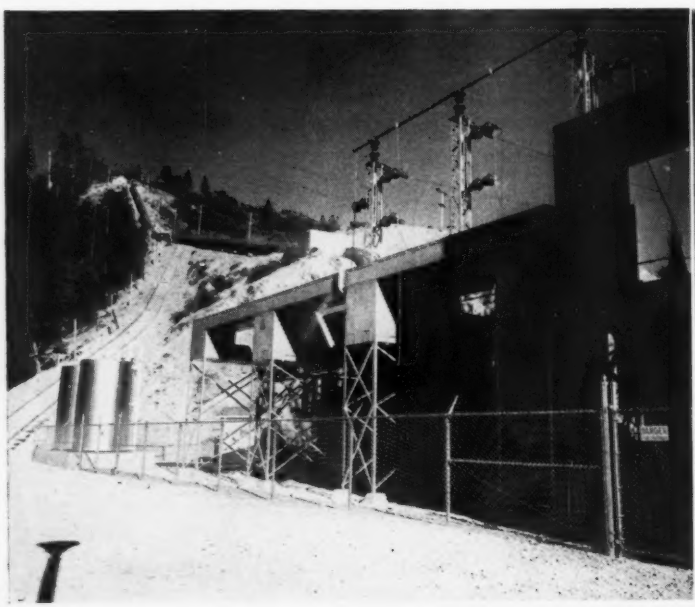
The 110-kv. and 11-kv. transformer transfer switches are arranged so that the operation of one control handle permits substituting the spare for any one of the three units in operation with only one manipulation to perform.

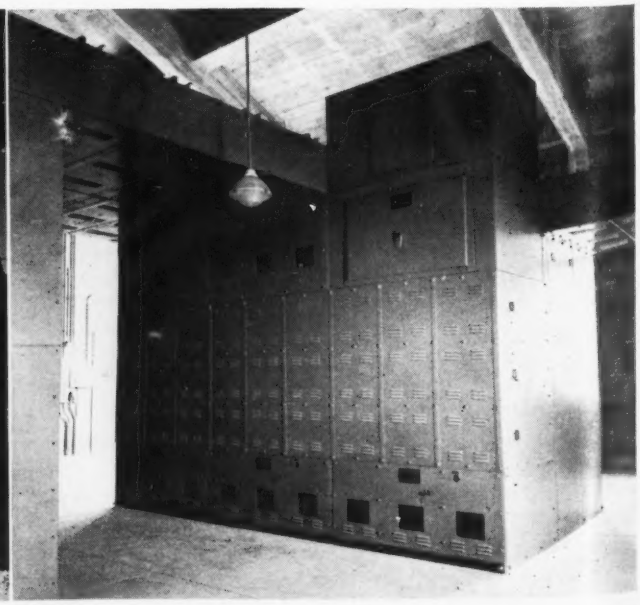
Automatic Features

Automatic features of this plant are similar to those of other automatic plants on the PG and E system. The plant is provided with an automatic-manual transfer switch so that on the manual position certain automatic features are cut out to prevent shutting down of the unit. Thus the plant becomes a manually operated plant retaining the main protective features that are normally used in such plants. As previously stated, the plant may be made fully automatic at a later date with a minimum of additions and changes.

It is to be noted that throughout the job every effort was made to simplify design, utilize factory assemblies insofar as possible to reduce field costs, and yet provide ample safety devices as well as those features that make for simple trouble-free operation—all in keeping with the most advanced ideas in hydro design.

Main outdoor 11-kv bus, transformer bus and low-tension transfer switches are all protected with metal enclosures. The 11-kv metal-clad switchgear shown at right is a factory-assembled unit





Distribution Fundamentals

Dear George:

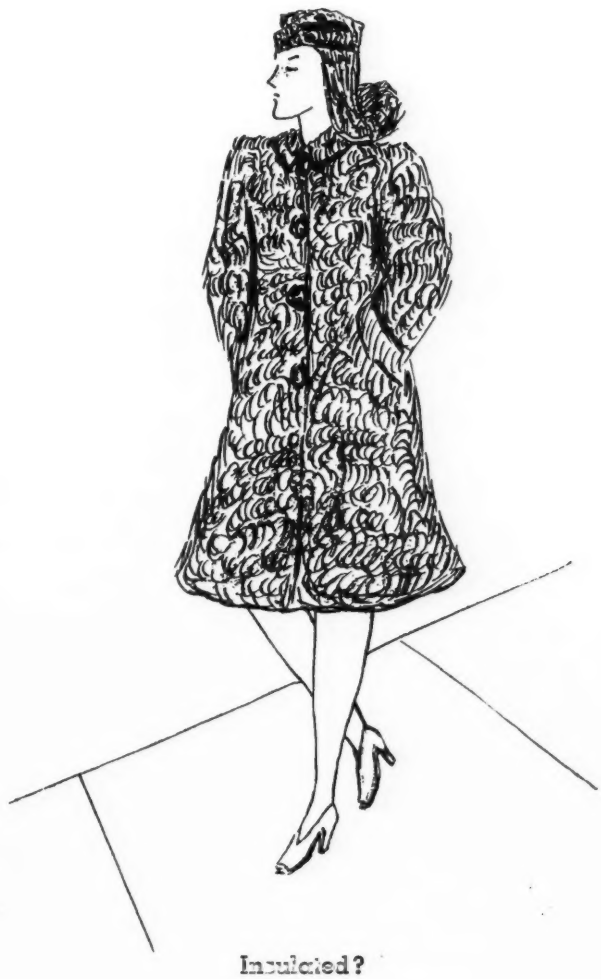
LEONARDO DA VINCI claimed that there was no beauty in a straight line, but he left out his opinion of a bare one. Whether in the swim or on the go, the primary purpose of the "Bell" of Manhattan is to put through telephone calls. It's the same way with those live wires in the alleys—their primary purpose is to take electricity from the rivers and the steam boilers to the customers' refrigerators and furnace thermostats, and they've got to do it in such a way that the company's treasurer won't be embarrassed when bond interest day rolls around. So we get to the $64 question: "Should they be bare or insulated?"

To get the real beans on the situation, we ought to turn the clock back forty or fifty years, and find out why someone wanted to hold the bag when the Gauls sacked Rome.

During the pioneering days of alternating current, the element of danger (designated by the symbol "red" in all chemistry books) was always associated with this system. Legislation was enacted to limit its voltage and usage in various states. Opponents of alternating current distribution were as jumpy as the first Broncho Billy movie thrillers, and if they had panned gold the way they did George Westinghouse's pet idea, they'd have had a hundred million froghides within 30 working days. The "Danger" was just a side issue like pretzels at a beer party, but when somebody starts slugging with brass knuckles, there're bound to be a few black eyes. Thus we got the eleventh Commandment that all overhead wires within the city limits must be insulated. Such ordinances in this day and age would be comparable to one giving horses jurisdiction on all paved streets. "Let's go, team!"

Weatherproof wire does not seem to be made to any voltage specifications, and its insulating value above a couple thousand volts is quite doubtful—at least no lineman should try chinning himself on a primary circuit. At higher distribution voltages, a man had better insulate himself instead of the wire. Much weatherproof wire is soft drawn, so the strength is less than hard drawn. The larger diameter of covered wire makes it more vulnerable to wind and sleet. It will burn down quicker than bare, too, once an arc has started, due to the concentration of the arc at the point of insulation failure. On top of these disadvantages its cost, installed, will run appreciably higher than bare hard drawn. And in 25 years it's bare anyway. On secondary service drops, weatherproof wire runs the gauntlet and holds its own without question, but on the rest of the line it's here today and gone tomorrow. Bare hard drawn wire sings in the wind,

Bare . . . . or



Insulated?

and laughs at its secondary cousin. I have heard it said that he who laughs, lasts!

Yours,

THE OLD SOUP.

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Utility Uses Two-Way FM Dispatching

Instantaneous communication is provided with field crews by new Department of Water & Power system at Los Angeles. Lower noise level, less interference and greater coverage result from use of FM system

STATION KFMQ recently was placed on the air by the Department of Water & Power of Los Angeles to provide instantaneous two-way communication with patrol and emergency crews. The system is of the new FM, or frequency modulated type as differentiated from the conventional AM, or amplitude modulated system and possesses many important advantages over the latter. Chief of these are inherently low noise level: almost complete absence of electrical interference and greater reliability of coverage by reaching into otherwise low signal level and dead areas.

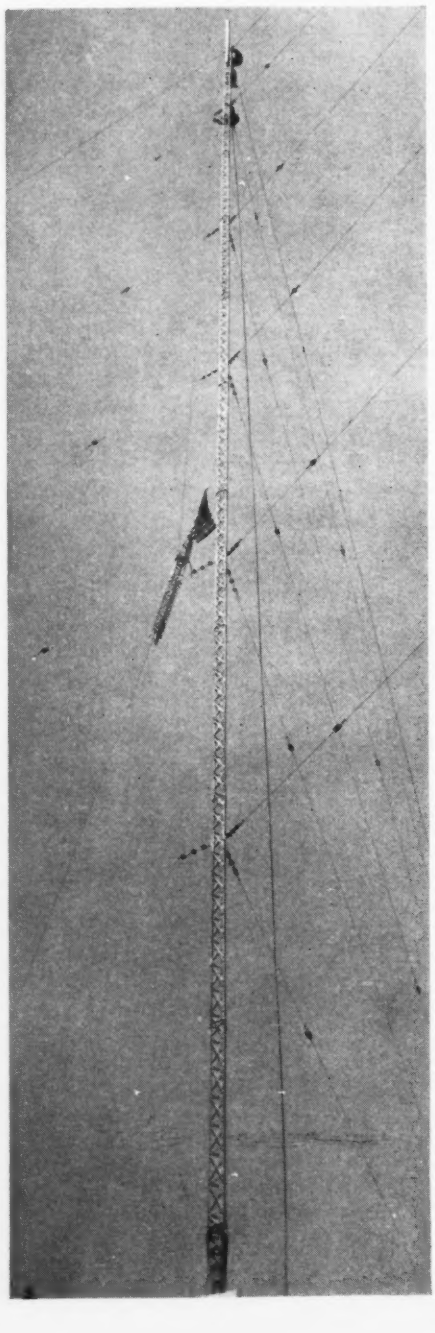
The system consists of a 1,000-watt transmitter, nine two-way, 25-watt, mobile transmitters and receivers and 25 receivers only in patrol and emergency cars. It supplements department-owned wire lines, teletype, radio telegraph and carrier communication facilities within the area of 450 square miles encompassed by the city of Los Angeles. Operation of the new communication system not only fits in with the department's anti-sabotage program, but also raises to even higher standards its ability to maintain continuity of water and electric services, doubly important now because of the great amount of war material being manufactured in this area.

FM vs. AM

Although the principles of frequency modulation have long been known to radio engineers, it is only recently that they have been perfected to the point where advantages over the older amplitude modulation method could be fully utilized. Major difference in the two methods of radio communication is the fact that frequency modulation permits use of a constant signal strength or voltage, whereas with amplitude modulation, strength of the signal may vary with the intensity of the sound impressed upon the carrier.

Frequency modulation also is less affected by noise and electric storm disturbances. Although frequencies available to public utilities for FM operation are in the ultra high frequency spectrum and are generally considered as being suitable for line of sight communication only, the broader band of frequencies employed by FM, with consequent increase in reflections, and the greater level of receiver sensitivity made possible through the use of noise reduction circuits, provide a far greater area of usable transmission than is practicable with AM. As one example of greater coverage it is interesting to note that FM permits reception in tunnels where an AM signal fades out entirely. Moreover, the power required for 100% modulation is much less with FM than with AM.

Erecting the last section of the 250-ft. antenna mast for the new radio station



FM utilizes a number of newly developed circuits in order to realize its many advantages. The most popular circuit in use to produce a frequency modulated carrier is that developed by Major E. H. Armstrong. Being both simple and stable in operation it is especially recommended for use in unattended and mobile types of equipment.

A phase shift is obtained in this circuit by using two balanced modulator tubes, the injector grids of which are driven from a phase-shifting network in the output of a crystal controlled oscillator. Design of this network is such that the grid of one tube is advanced by 45° and the other likewise retarded, causing the plate currents to be 90° out of the phase. The control grids of the same modulator tubes are fed from a push-pull transformer connected directly to the audio line. Any speech applied to the line will then cause the plate currents to vary about mean values and as one increases the other decreases. In the output transformer of the modulator stage these leading and lagging currents add vectorially, producing a resultant whose phase is shifting along the time axis, thus effecting a change in frequency. Due to the relatively small change in frequency produced by this method of modulation it is necessary to use frequency multipliers, in order that a reasonable amount of frequency deviation be realized. These multiplier stages employ low-power receiving type tubes, the final stage of which drives a class C amplifier stage.

Although FM simplifies the transmitter, the receiver is considerably more complicated than with AM. Receivers for FM must have sufficient band width to pass all frequencies generated by the transmitter, sufficient gain to operate a limiting device on weak signals and a detector to respond only to variations in frequency. Space will not permit a complete description of this most interesting receiver. Suffice to say that it is in the circuits of

this ingenious receiver primarily that lies the secret of noise reduction that characterizes FM.

Main Transmitter

The FM equipment now in operation consists of a main station transmitter and receiver with associated equipment for remote operation. In addition there are the nine two-way mobile units and 25 mobile receivers above mentioned. The main transmitter operates on a carrier frequency of 39,660 kc. Using the Armstrong phase shifting system of modulation, the crystal frequency of 1,239.375 kc.

Modulation is simplified with the FM system of broadcasting. Burton A. Currie, communication engineer, is shown checking the main transmitter

is quadrupled twice and doubled once to obtain the final carrier frequency.

The antenna is of the concentric dipole type mounted on a tower over 200 ft. in height. The same antenna is used for both transmission and reception. Although adjusted for maximum efficiency at the transmitter frequency any reduction in efficiency at the received frequency is compensated for by high over-all receiver sensitivity. A gas engine-driven generator provides emergency power supply.

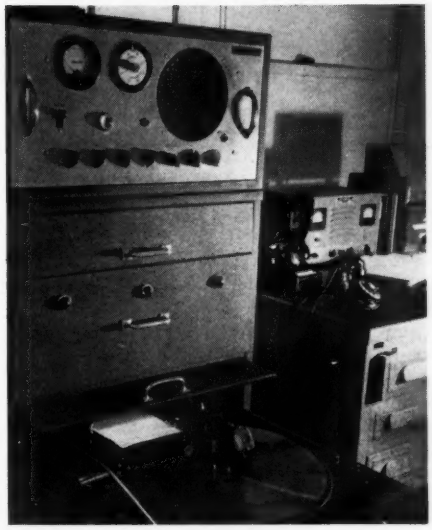
The main station equipment is normally operated by remote control from any one of three points. The main control unit is located in the communications office with auxiliary units placed in water and power trouble dispatchers offices. Both transmission and reception of signals are heard at all three points.

The main station receiver output is normally connected to all control unit speakers. When the operator or dispatcher is called or wishes to make a call, lifting the telephone handset off the hook automatically transfers incoming signals from the speaker to the handset in that particular unit. Pressing the push to talk switch on the handset energizes control relays which transfer the antenna from the receiver to the transmitter, energize the transmitter input and plate supply circuits and operate pilot lights at the other control points to indicate that the circuit is busy.

Broadcasts Monitored

All broadcasts are monitored by licensed operators. To facilitate the logging of actual transmissions, a recording machine has been installed to transcribe automatically both the main station and mobile broadcasts. Using the embossing method of transcription each record has a capacity of approximately 120 minutes playing time. Other features found in this equipment include play-back amplifier and speaker, compression amplifier and two separate recording tables for overlapping of records.

The mobile equipment employs the same general circuit design as that used in the main station equipment. Receiver and transmitter units are mounted in the rear baggage compartment of sedans while special steel lockers are provided for installations in larger trucks and trouble cars. Complete remote operation of the equipment is provided by means of a push to talk handset, a loud speaker and a control head with receive and transmit pilot lights, battery switch and volume control, all of which is installed in the drivers compartment.

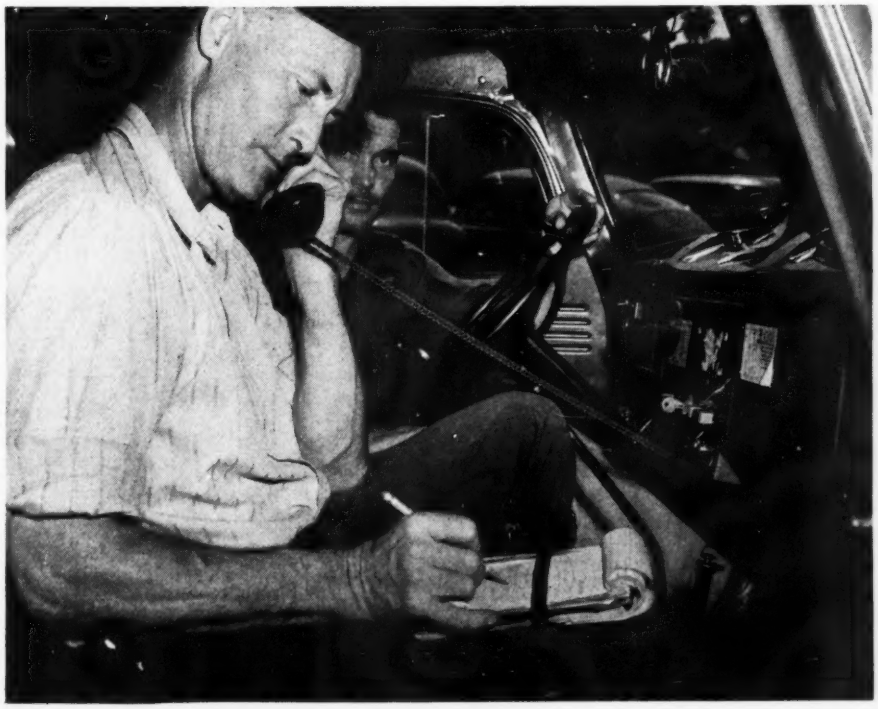


All broadcasts are automatically transscribed by the embossing method on two-hour records with the new system

Economies resulting from the operation of this system include a more efficient disposition of field forces, a closer coordination of field activities during periods of emergency and a reduction in hazard to life, public safety or property incident to such emergency.

The equipment was built by the Fred M. Link Company to department specifications and was installed under the supervision of Burton A. Currie, communication engineer.

The emergency dispatcher's dream comes true—instant two-way communication with field crews is provided by mobile equipment in the trouble cars



Penstock, Tunnel, Flow Line Maintenance

Edison Co. makes every effort to maintain maximum water flow; asphalt finds extensive use; tunnel washing machine removes Caddis-fly growth

T. C. Stavert
Southern California Edison Co. Ltd.
Los Angeles, Calif.

INSPECTION and maintenance of penstocks, tunnels and flow lines to insure continuous, unobstructed flow of water is of prime importance in the operation of hydroelectric generating plants. Any failure of the lines used to conduct water seriously affects the whole installation.

Having a large number of hydro plants, both large and small, utilizing all the various means of carrying water, the Southern California Edison Co. Ltd. naturally has had many interesting problems to solve, both ordinary and unusual. Some of the maintenance methods developed over a long period of years should prove of interest to others having similar problems.

Penstocks

With the exception of infrequent inspection, it has been found unnecessary to do a great deal of maintenance work on penstocks. Various types of protective coatings have been used on the inside of penstocks with little success. In some of the older plants that have been in operation from 30 to 40 years the pitting and rusting of penstocks is now reaching such a point that an extensive replacement program will probably be required within the next 10 years.

In these old installations where the exterior of the pipe is coated with asphalt, it is in comparatively good condition. Uncoated pipe in one case was found to be pitted to a depth of two-thirds of the wall thickness.

One of the most troublesome problems in the operation of tunnels and flow lines is the maintenance of a continuous flow at maximum capacity, depending on water availability. Any restriction of flow seriously affects plant output and every effort is made to keep the lines clear. The most serious form of restriction encountered is the growth of Caddis-fly larvae on the walls of tunnels, flumes and pipelines. This growth is very rapid in lines which carry water at a high velocity. The insects attach themselves to the concrete linings of waterways, increasing friction and resulting in a loss of water delivery as high as 10% in many cases.

Each spring the larvae migrate into the tunnels and form an accumulation on the walls that extends about a mile below the intake. The removal of this growth is done yearly, usually in the late spring in the case of tunnels and as often as necessary in open flumes and pipelines. This used to be done by unskilled labor using scrapers and brushes. From 20 to 25 men could clean a tunnel in 6 to 8 hours. Scarcity of labor in recent years made it necessary to develop some other method of cleaning.

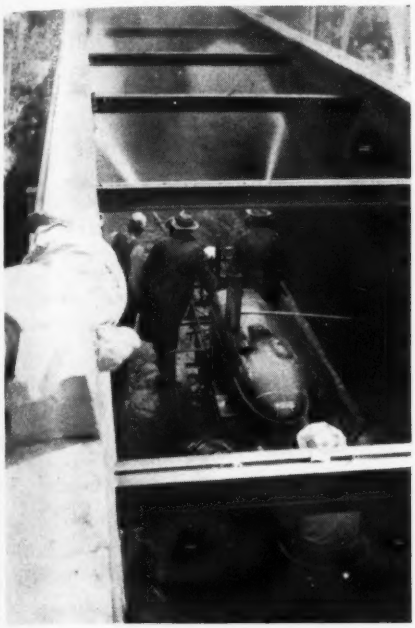
A tractor washing machine has been developed by the Edison company for this purpose and has proved very satisfactory. The tractor has a 250-g.p.m. water pump that sucks water from the tunnel floor and sends it through two ⅝-in. nozzles at a pressure of 90 lb. per sq.in. The nozzles may be directed against the tunnel sides and floor at any angle found desirable for washing away the growths. To increase their effectiveness, the nozzles, actuated by a crank mechanism driven from the tractor by a V-belt, swing back and forth.

The air in the tunnel is kept free of exhaust fumes by a large ventilating fan at the tunnel entrance. Only three men are required to wash a tunnel with this tractor outfit. About one mile of tunnel can be washed in six hours.

Large open flumes are cleaned by hand scraping with wire brushes. Flumes have been cleaned by hand scraping on a number of occasions while carrying a full head of 400 sec.ft. of water at high velocity.

Pipelines between 20 in. and 40 in. in diameter are cleaned by sweeping with a bundle of live oak branches. The branches are made up by wiring them in the form of a ball with a diameter about one and one-half times that of the pipe to be cleaned. With a full flow of water this bundle of brush is dropped into the pipe intake and allowed to pass through the pipe with the water. Experiments are under way to develop if possible some means of Caddis-fly control that will obviate all of this cleaning.

Left: Caddis-fly larvae webbing on walls and floor of Kern River No. 3 tunnel. Clear spots indicate location of hydraulic grease applied previous year, which application was in effect the second year. Right: Tractor-mounted washing machine displaces hand methods of cleaning tunnels



High-pressure water jet from tractor-mounted pump will effectively clean about one mile of tunnel in six hours

Concrete Deterioration

The deterioration of concrete due to spalling, leaching or disintegration of aggregate is always a problem. Experience has shown that such damage is most satisfactorily repaired by cleaning off all loose material and applying gunite to the damaged surfaces. This provides a very compact surface resistant to further damage. Gunite has been used in the repair of concrete ditch lining and on structures and covered flumes used for the conveyance of water, with good results.

When time has not been available for other repair methods, hand patching has been done on the concrete linings of low tunnels with satisfactory results. Quick setting cement or a cement-calcium chloride mix in the ratio of 1½ lb. to the sack of cement, troweled to a smooth surface, has been used with satisfaction.

In making tunnel inspections it is very important that good light be provided. The common miner's acetylene lamp has been found to be most satisfactory. On a regular inspection two or preferably three men are used. With this number, walking slowly, there is little chance of overlooking failures or other defects.

Asphalt Extensively Used

The scouring of steel flumes due to water-borne sand and silt has been effectively stopped by the regular application of hot asphalt to the wearing surfaces of the steel sheets. Experience would indicate that this should be done every five to eight years, depending on the amount of abrasive material carried by the water. On a recent job the cost of applying hot asphalt to a flume, including the cost of cleaning and other preparatory work, was $.006 per sq.ft. of flume surface, one coat. This flume has a radius of 42 in.

Equipment used for heating and applying asphalt was developed on the job. A wheeled kettle, small enough to be used directly in a flume, was fabricated. Rubber-tired wheels taken from wheelbarrows on the job were mounted on an underslung frame on which the heating kettle was placed. Two kerosene weed burners with tanks, mounted on the cart, were used as a source of heat.

Most of the company's waterways pass through forest reserves. Warm, dry weather is most desirable for the application of hot asphalt. As this kind of weather occurs only during the fire hazard season any heating equipment must be approved by officials of the U. S. Forest Service. Approval for use of the heating unit described was obtained. The heating of asphalt by the old open fire method is no longer allowed in this area during the fire season.

Roofing asphalt with a melting point of approximately 180° is used for flume coating. This material is heated to a temperature of about 400° and is applied to the flume with cotton mops. With the heating kettle in the flume it is possible to deliver hot asphalt to the point of application with a minimum of labor and loss of heat.

During the past several years, in an effort to prolong the service life of large wooden flumes, 18-gage galvanized sheet steel lining has been installed on the inside of the flume box. Standard sheets of 36-in. width are used and are secured at the joints by self-tapping screws. Galvanized nails, driven through the sheets into the flume walls, attach the sheets to the flume. A coating of asphalt is applied to the inside of the sheets to protect against scouring. The first job of this kind was done three years ago and results appear to be very satisfactory.

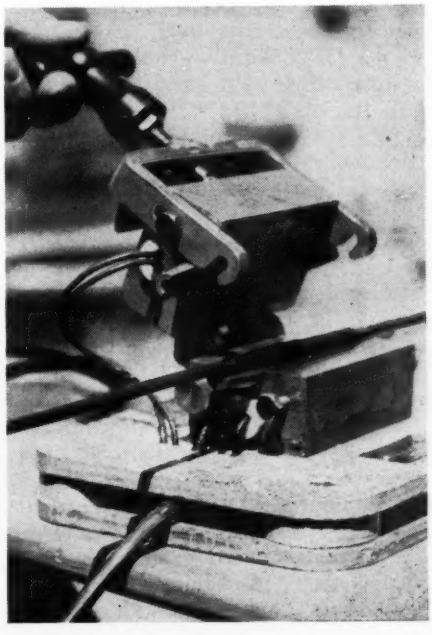
In a smaller wooden flume, 22-gage black iron sheets were installed as lining eight years ago. Before this installation the flume had deteriorated to such an extent that leakage losses were excessive. Chemical action, evidently set up by the combination of the redwood of the flume and water, has damaged the underside of the steel sheets to such an extent that replacements must now be made. Because of the extreme shortage of steel at the present time a section of the flume is now being lined with asphalt roofing, as an experiment.

Electrical Vulcanizing Mould

SCARCITY of rubber-covered wire has led PG and E to use of synthetic insulated wires for switchboards, interconnecting wiring, etc. The synthetic used is excellent, but some difficulty has been experienced in the insulating of splices, especially on underground services where a moulded splice is to be preferred. The manufacturer recommends wrapping with synthetic tape and then vulcanizing. This calls for a uniform temperature throughout the mould and exactly the right heat.

To overcome the difficulties encountered when using a flame torch for this purpose, F. P. Reardon, construction foreman for PG and E, developed the electrically heated, thermostatically controlled mould shown in the accompanying illustration. Two 125-watt, cartridge heaters were used, one in each block. A cartridge type thermostat controls the temperature to 310° F., within 0.2 of one degree. Not more than five minutes is required for vulcanizing a splice. Tests show a dielectric strength of 22,000 volts, which is greater than the regular insulation. The device is portable, weighing only 15 lb., and can be conveniently used anywhere on the job.

This idea received first award in the 1942 PG and E employee suggestion plan operated by a research committee under the chairmanship of W. G. Vincent, vice-president and executive engineer.



Salvage

Bits of sales flotsam picked up in these times

"*WE did a great deal of talking* about the man who wasn't there, but the dealer never lacked for champions," reads the report of Chamberlain, San Diego's manager of the Radio and Electrical Appliance Bureau, in reporting the recent PCEA conferences in Hollywood and San Francisco. Other pertinent excerpts from this meaty report are:

"*On the other hand* there is a greater need than ever to fight for the very existence of our remaining service dealers and for the facilities they require to carry on.

"Number one on the list of dealer difficulties now appears to be the matter of personnel. From all sections reporting it was found that much good has been worked through the various training programs being carried on under sponsorship of vocational schools. Courses covered included general appliance repair, refrigeration and radio principally. At first, these courses drew students without much trouble, but now it is becoming most difficult to get enrollees against the possibility of very high wages in various war plant activities. With dealers still losing men through one cause or another, it is essential that replacements be trained, but where to get them is the question. Evidence here indicated that more responsibility must be placed on the dealer to help secure trainees. Heretofore the utility, association or other agency concerned has shouldered this responsibility. The rapidly falling enrollments in some quarters indicate that unless the dealer is able at least to help secure potential service personnel for this training, the programs of this nature will quickly dwindle in importance.

"Having been chided for a tendency to curtail dealer calls of field men, both manufacturers and distributors appeared to counter with testimony of other activities of a somewhat intangible nature. It has been shown that nothing is more helpful to a dealer in trouble than the opportunity to talk to someone who has a helpful answer. Now of all times, store calls are appreciated because most dealers are finding it difficult to get away. Following considerable discussion of this point, it appeared that several concerns were sufficiently impressed with the facts brought out to promise increased efforts in this direction. The over-all value of stepped-up field contacts would alone be sufficient to save many shaky dealers."

● CASHING IN OLD APPLIANCES for war stamps is being advocated in a number of communities by Pacific Gas and Electric Co. in cooperation with dealers. The old appliances are taken to one of the dealers. A dollar minimum in war stamps is offered for any appliance in repairable condition with a statement made that more will be offered for larger appliances or those in better condition. A list of the dealers to whom the old appliances may be turned in under this plan is published with each advertisement.

● SILK SUBSTITUTES and new fabrics to be evolved from the synthetic fibers now being produced for war purposes will require special treatment for pressing, the Silex Co. maintains, and has announced a new automatic electric steam iron to be made available after the war. Seven thousand were produced before war restrictions and these are being used as laboratory models in as many homes.

● A PRIORITY CLUB has been set up by Schoenfelds' Standard Furniture Co. in Seattle, Tacoma, Bremerton and Everett, by which customers are assigned a priority number on any appliance merchandise which may become available, either from presently frozen stocks or from new manufacture. This number gives that person his turn in line for available merchandise, requires no down payment or advance deposit.

● MRS. THELMA WATSON, home economist for Utah Power & Light Co., has been transferred from Rexburg, Idaho, to the company's southern territory with headquarters at American Fork, replacing Miss Evelyn Hansen, who joined the WAVES recently. Her services are made available to dealers for assisting their customers in the efficient care and use of their electrical appliances.

● TO SELL VACUUM CLEANER SERVICE on a house-to-house basis, the Electric Vacuum Cleaner Co., Cleveland, makes available to dealers a four-postcard direct mail campaign promoting a $1.20 "bring it in" special or a $1.85 "in your home" special, either of which affords the dealer an opportunity to sell a complete certified, guaranteed service job.

● HOW TWO MONTANANS, one from Butte, the other Anaconda, have set up a "solarium" in the Aleutians using electrically made sunlight from ultraviolet sources is told by Captain M. M. Witherspoon, U.S.N., in an interesting account in the Montana *Standard*. The two men are Chief Specialist Swan Johnson, U. S. Navy, of Butte, formerly a physio-therapist who operated as such in Butte, and Pharmacist's Mate Third Class Carl Bloom, of Anaconda, who is now in charge of the solarium. To supply badly needed sunshine to the fighting men in the fog-bound Aleutians, this solarium is for treatment of soldiers, sailors and marines.

● PACIFIC APPLIANCE CO., at 2767 Mission St., San Francisco, after its owner William Heyman had made a trip to Eastern markets, has been offering cord sets, wringer rolls, batteries and other items on a wholesale basis. The company continues to operate its appliance service and repair business at 2862 Mission.

● UNFROZEN REFRIGERATORS were advertised by Sears, Roebuck and Co. with a list of qualifications under government requirements for the purchase of new refrigerators. A series of questions was asked; if the customer could say "yes" to each one, he would be eligible.

● CONVERTED BOTTLE COOLERS appeared in Seattle as refrigerators, advertised by MacDougall's in a recent advertisement. The Crosley bottle cooler was equipped with racks for handling of home refrigeration and sold at $249.95 with a five-year warranty.

● UNIT FURNITURE is being developed as a sales leader by Warman's at Vancouver, B. C., as a substitute for electrical appliances. The unit type of furniture can be arranged in a variety of combinations.

● ERNST HARDWARE CO., of Seattle, advertised a $5.25 special of a single-tube fluorescent fixture for home or shop.

Gone with the war are all the snappy appliance campaigns Steve Rhodes, Pocatello sales manager, Idaho Power, used to stage manage, but he and Joe Geemoe, his soup salesman extraordinary, can be seen doing a little postwar planning on their own hook or crook

AUTHORIZED ELECTRICAL APPLIANCE SERVICE STATIONS

IN THE ELEVEN WESTERN STATES

SEPT. Compiled by ***ELECTRICAL WEST*** 68 Post St. **1943**

San Francisco 4, Calif. Additional copies free on request.

Dealers—Keep Handy for Reference

Includes domestic appliances, water systems, coal stokers, oil burners and fractional horsepower motors. Listed by manufacturers alphabetically. Trade names in italics. Postoffice zone numbers in parentheses after city name. Listing was offered free to all manufacturers. All who responded have been included. Additions or revisions should be sent to Electrical West, which endeavors to keep a current file of such information for your benefit.

When returning appliances for repair, be sure to give complete information on tag attached to appliance. (1) Your name and address. (2) Tell what's wrong with the appliance. (3) State if repairs are expected under a guarantee, state whether you authorize repairs or merely want a quotation first as to the estimated cost.

ACME ELEC. HEATING CO., 1217 Washington St., Boston, Mass.
(Acme heaters)
Factory service only.

ADVANCE MFG. CO., (subsidiary of Star Mfg. Co.) 6324 St. Louis Ave., St. Louis, Mo.
(electric appliances)
Factory service only.

ALTORFER BROS. CO., Peoria, Ill.
(ABC household washers and ironers)
Factory Branch: 324 N. San Pedro St., Los Angeles
Service stations:
Seattle: Appliance Parts & Service Co., 214 Stewart St. (1)
Portland: W. L. May Co., 24 N.W. Broadway (9)
San Francisco: Thompson & Holmes, Ltd., 2701 16th St. (3); Washing Mach. Parts Co., 1321 Mission St. (3)
Los Angeles: Elec'l Appl. Service Corp., 726 W. Venice Blvd. (15); Listenwalter & Gough, Inc., 827 E. First St. (13)
San Diego: San Diego Standard Elec. Corp., 1407 Columbia St.
Denver: Austin Appliance Co., 414 15th St.
Salt Lake City: Strevell-Paterson Co. (for Nev., Utah, Wyo., Ida.)
Phoenix: Arizona Hdwe. Co., First & Jackson Sts.
Albuquerque: J. Korber & Co.

AMERICAN IRONING MACHINE CO., Algonquin, Ill.
(Simplex ironer)
Seattle: Appliance Parts & Service, 214 Steward St. (1); F. B. Connelly Co., 1015 Republican St. (9); McDougall & Southwick Co., 2nd Ave. at Pike (1)
Tacoma: Love Elec. Co., 732 Pacific.
Portland: W. L. May Co., 122 S.W. 5th Ave. (4); Northern Wholesale Hdwe. Co., 109 S.E. Salmon St. (14).
San Francisco: Hale Bros., 5th & Market Sts. (3).
Los Angeles: Elec'l Appliance Service Corp., 726 W. Venice Blvd. (15); Leo J. Meyberg Co., 2027 S. Figueroa St. (7).
Long Beach: Speed Queen Washer Sales Co., 831 E. 4th St.
Denver: Auto Equip Co., 14th at Lawrence; Morey Mercantile Co., P. O. Box 5150 Terminal Annex.
Salt Lake City: Salt Lake Hdwe. Co., 103 N. 3rd St. W. (3).

ANSLEY RADIO CORP., 21-10 49th Ave., L. I. City, N. Y.
(Ansley Dynaphone, DynaTone, DynaFlash)
Seattle: Sherman, Clay & Co., 1624 Fourth Ave. (1).
Portland: Sherman, Clay & Co., 625 S.W. Washington St. (5).
San Francisco: City of Paris, Geary & Stockton Sts. (8); Schwabacher-Frey Co., 735 Market St. (3); Sherman, Clay & Co., Kearny & Sutter Sts. (8).
Oakland: Sherman, Clay & Co., 3320 Broadway (11).
Sacramento: Weinstock-Lubin Co., "K" St. & 12th.
Los Angeles: Gateway to Music, 3305 Wilshire Blvd.

THE APEX ELEC'L MFG. CO., 1070 E. 152d St., Cleveland, O.
(Apex, Rotarex cleaners, washers, ironers; Faultless washers & ironers)
Parts and service:
Seattle: Appliance Parts & Service Co., 214 Stewart St. (1).
Portland: W. L. May Co., 215 N.W. Park Ave. (9).
Oakland: Apex Appliance Service, 527 E. 8th St. (6).
Los Angeles: Elec'l Appliance Service Corp., 726 W. Venice Blvd. (15).
Salt Lake City: Apex Sales & Service Co., 171 E. Broadway.
Parts only:
San Francisco: Washing Machine Parts Co., 1321 Mission St. (3).

APPLIANCE MFG. CO., Alliance, Ohio.
(Duchess and Kelvinator washing machines)
Distributors:
Seattle: Harper-Meggee, Inc., Republican & Terry (9).
Denver: Larson Distr. Co., 1269 Broadway.
Salt Lake City: Flint Distr. Co., 316 W. 2nd So. St.
Parts only:
Seattle: Appliance Parts & Service Co., 214 Stewart St. (1).
Portland: W. L. May Co., 215 N. Park Ave. (9).
San Francisco: Washing Machine Parts Co., 1321 Mission St. (3).
Los Angeles: Washing Machine Parts Co., 1241 S. Hope St. (15).
Phoenix: Elec'l Equipment Co., 424 N. Central Ave.

AUTOMATIC WASHER CO., Newton, Iowa.
(Automatic washers & ironers; Prima washers)
Los Angeles: Elec'l Appliance Service, 726 W. Venice Blvd. (15).
Genuine repair parts for Prima washers can be furnished from factory.

BARLOW & SEELIG MFG. CO., Ripon, Wis.
(Speed Queen washers & ironers)
Seattle: Appliance Parts & Service Co., 216 Stewart St. (1).
Los Angeles: Elec'l Appliance Service Corp., 726 W. Venice Blvd. (15).
Dallas: Manufacturers Sales Co., 1001 Broom St.

BAUER MFG. CORP., 7006 Stanford Ave., Los Angeles (1), Calif.
(B & F elec. wall and water heaters)
Factory service only.

BENDIX HOME APPLIANCES, INC., 3300 W. Sample St., South Bend, Ind.
(Bendix Home Laundry)
Distributors from whom service may be secured:
Seattle: Harper-Meggee, Inc., 960 Republican St. (9).
Spokane: Harper-Meggee, Inc., S. 163 Lincoln.
Portland: Harper-Meggee, Inc., 1506 N.W. Irving St. (9).
San Francisco: Leo J. Meyberg Co., 70 10th St. (3).
Los Angeles: Leo J. Meyberg Co., 2027 S. Figueroa St. (7).
Denver: Larson Distr. Co., 1269 Broadway (Colo. & N. M.)
Salt Lake City: Flint Distr. Co., 316 W. 2nd So. St. (Utah, Ida., Wyo.)
Phoenix: Elec'l Equipment Co., 424 N. Central Ave.
Billings: Northwestern Auto Supply Co., 429 N. Broadway (Mont., Wyo.)
Honolulu: Nylen Bros. & Co., Ltd., 820 S. Beretania St.

BLACKSTONE CORP., Jamestown, N. Y.
(Blackstone washers & ironers)
Seattle: Appliance Parts & Service Co., 214 Stewart St. (1); Bon Marche: Woempner's, 1719 N. 45th St. (3).
Spokane: W. H. Dozier Co., S. 3 Washington St.
Walla Walla: Empire Furniture Co., Main at Colville.
Yakima: Shurman-Keith Co.
Everett: Markham's Washer Shop, 2630 Colby Ave.
Portland: W. L. May Co., 215 N.W. Park Ave. (9); Bader Distr. Co., 109 Security Bldg. (4).
San Francisco: Dohrmann Com'l Co., 984 Mission St. (3); C. G. Hamilton Co., 1355 Market St. (3); Mission Elec. Co., 19th & Valencia St. (3); Washing Machine Parts Co., 1321 Mission St. (3).
Oakland: Jackson Furniture Co., 13th & Clay (12).
Los Angeles: Elec'l Appliance Service Corp., 726 W. Venice Blvd. (15); Kelly's Appliance Service, 1325 W. Jefferson Blvd. (7); Washing Machine Parts Co., 1241 S. Hope St. (15).
Denver: Geo. S. Conley, 731 15th St. (2).
Pueblo: Ingle's Washing Machine Exchange, 417 N. Santa Fe.
Salt Lake City: Hanco Furniture Stores, 701 S. State St.
Tucson: Steinfeld's.
Reno: H. E. Saviers & Sons, Inc., 2nd & West Sts.
Boise: Broadway Commission, 1001 Broadway.
Great Falls: Reynold Plath, 326 2nd Ave., S.W.

CANTON CLOTHES DRYER CO., 368 Clark Bldg., Canton, O.
(Canton clothes dryer)
Factory service only.

CHICAGO DRYER CO., 2210 N. Pulaski Rd., Chicago, Ill.
(Chicago washer, ironer, clothes dryer, laundry equip.)
Factory service only.

CHICAGO ELEC. MFG. CO., 6333 W. 65th St., Chicago, Ill.
(Handyhot appliances)
Factory service only.

CLEMENTS MFG. CO., 6650 S. Narragansett Ave., Chicago (38), Ill.
(Cadillac elec. vacuum cleaner)
Seattle: Appliance Parts & Service Co., 214 Stewart St. (1); Globe Elec. Co., 307 First Ave. S. (4).
Portland: Stark's Vacuum Cleaner Sales & Service, 519 E. Burnside (14).
Los Angeles: Jesse M. Few, 929 W. 8th St. (14).
Salt Lake City: Z.C.M.I., 351 ZCMI Ave.

COLLINS CONCRETE & STEEL PIPE CO., 3841 N. Columbia Blvd., Portland (3), Ore.
(Collins and Watermaster elec. water heaters)
Factory service only. Defective parts should be returned with order.

CONNECTICUT APPLIANCE CO., Winsted, Conn.
(Coronet appliances)
Seattle: Howell's Elec. & Supply Co., 522 Union St. (1).
San Francisco: Will M. Aronson, 955 Folsom St. (7).
Los Angeles: State Appliance Co., 451 E. 4th St. (13).
Most parts available from all stations; heat pads repaired at home office only.

DeWALD RADIO MFG. CORP., 440 Lafayette St., New York City.
(DeWald and Electrocall radios)
Factory service only.

EDISON GENERAL ELEC. APPLIANCE CO., INC., 5600 W. Taylor St., Chicago, Ill.
(Hotpoint ranges, water heaters, refrigerators, washers, ironers, dishwashers, dryers, disposalls, Electra-Sinks; Edison-Hotpoint commercial cooking equipment)
Household Appliances:
Seattle: Graybar Elec. Co., Inc., King & Occidental Sts. (4).
Spokane: Graybar Elec. Co., Inc., 152 So. Post St.
Tacoma: Graybar Elec. Co., Inc., 1214 "A" St.
Portland: Graybar Elec. Co., Inc., 809 N.W. Flanders St. (9); Stubbs Elec. Co., 33 N.W. Park Ave. (9).
San Francisco: Graybar Elec. Co., Inc., 9th & Howard Sts. (3).
Fresno: General Elec. Supply Corp., 1234 "O" St.
Los Angeles: General Elec. Supply Corp., 700 Turner St. (12).
San Diego: General Elec. Supply Corp., 206 W. Market St.
Denver: General Elec. Supply Corp., 1429 18th St.

Salt Lake City: Graybar Elec. Co., Inc., 245 S. First W. St.
Phoenix: General Elec. Supply Corp., 441 W. Madison St.
Honolulu: Hawaiian Elec. Co.
Commercial Cooking Equipment:
Seattle: General Elec. Co. Service Shop, 1508 4th Ave. S. (4).
Portland: Bressie Elec. Co., 909 S.W. 5th Ave. (4).
San Francisco: Marine Elec. Co., 195 Fremont St. (5).
Los Angeles: Utility Repair Shop, 1928 W. 7th St. (5).
San Diego: Zweiner Elec. Co., 229 "B" St.
Salt Lake City: General Elec. Supply Corp., 310 W. 2nd So.
Honolulu: Hawaiian Electric Co.

ELEC'L RESEARCH LABORATORIES, INC., 2020 Ridge Ave., Evanston, Ill.
(Erla and Sentinel radios)
Seattle: James J. Backer Co., 2321 2nd Ave. (1) (Ore., Wash., Ida., Mont.)
Los Angeles: E. J. Jordan, 650 S. Grand Ave. (14) (Calif., Ariz., N.M., Nev.)
Denver: Parker Co., 1520 Wazee St. (Colo.)

ELECTRIC HOUSEHOLD UTILITIES CORP. (See Hurley Machine Div.)

ELECTRIC VACUUM CLEANER CO., INC., 1734 Ivanhoe Rd., Cleveland 10, Ohio.
(Premier and Magic-Aire vacuum cleaners)
Magic-Aire service:
Seattle: Seattle Hdwe. Co., 501 First Ave. S. (4).
Spokane: Jensen-Byrd Co., 314 Riverside Ave.
Portland: The Stubbs Co., 33 N.W. Park Ave. (9).
San Francisco: H. R. Basford Co., 425 Second St. (5).
Los Angeles: Associated Wholesale Elec. Co., 1111 Santee St.
Denver: Good Housekeeping Stores, 1610 Broadway.
Miles City, Mont.: Farm & Home Appliance Co., 609 Main St.
Premier service:
San Francisco: Premier Div., Elec. Vacuum Cleaner Co., 214 Chronicle Bldg. (3).
Los Angeles: Premier Div., Elec. Vacuum Cleaner Co., 953 Bendix Bldg.
Inter-Mountain States serviced from Omaha and Minneapolis branches.

ELECTROMASTER, INC., 1803 E. Atwater St., Detroit 31, Mich.
(Electrochef range; heavy duty elec. cooking equip.)
Utility company service stations in territory where sold.

ELECTRO TOOL CORP., 2420 Layard Ave., Racine, Wis.
(Nu Era Shaver, Whisker Shaver and Clipet Hair Clipper)
Factory service only.

THE ESTATE STOVE CO., Hamilton, Ohio.
(Heatrola and Estate ranges)
Distributors through whom service may be secured:
Seattle: Harper-Meggee, Inc., Republican & Terry Sts. (9).
Spokane: Tull & Gibbs, Inc.
Portland: Harper-Meggee, Inc., 1506 N.W. Irving St. (9).
Oakland: Household Products Co., 1721 Poplar St. (7).
El Paso: Momsen - Dunnegan - Ryan.

FAIRBANKS, MORSE & CO., 600 S. Michigan Ave., Chicago 5, Ill.
(Fairbanks, Morse water systems, washers and ironers)
Minor repairs by dealers in field; major repairs should be referred to branch offices:
Seattle: 1226 First Ave., S. (4) (Ore., Seattle, part Ida. & Mont.)
San Francisco: 630 Third St. (7) (Part Calif., Ida., Nev., Wyo., all Utah & Hawaiian Is.)
Los Angeles: 2401 Santa Fe Ave. (11) (Part Calif. & Nev., all Ariz.)
Dallas: Corbin & Market Sts. (2) (Part N. Mex.)
Kansas City: 13th & Liberty Sts. (7) (All Colo., part N. Mex.)
Omaha: 902 Harney St. (8) (Part Wyo.)
St. Paul: 220 E. 5th St. (1) (Part Mont.)

THE FILTEX CORP., 421 E. 15th St., Los Angeles 6, Calif.
(Hygienic Filtex cylinder type vacuum cleaner and air purifier)
Factory service only.

THE FITZGERALD MFG. CO., Torrington, Conn.
(Fitzgerald Magic Maid and Starrite appliances)
Service on all appliances:
Los Angeles: Factory Branch, 1147 S. Hope St. (15).
Mixers, Hotplates, Irons only:
Seattle: Howell's Electric Supply Co., 522 Union St. (1).
Portland: Morrison Elec. Co., S.W. Washington at 13th (5).
San Francisco: W. W. Aronson Co., 955 Folsom St. (7).

FLOOROLA PRODUCTS, INC., 560 Maryland Ave., York, Pa.
(Floorola floor polishers)
Minor repairs:
Los Angeles: Floorola Products of California, 1111 Trenton St. (15).
Major repairs:
Send to factory.

FLORENCE STOVE CO., Gardner, Mass.
(Florence elec. range—equipped with Chromalox units)
For Chromalox units see:
Edw. L. Wiegand Co.
Factory only for other service.

THE FORESTEK PLATING & MFG. CO., 9607 Quincy Ave., Cleveland 6, Ohio.
(Fortek sandwich toaster, food warmer trayette, table stove, combination sandwich toaster and waffle iron)
Factory service only.

FREE SEWING MACHINE CO., Rockford, Ill.
(Free - Westinghouse and New Home sewing machines)
For Free-Westinghouse machine:
See Westinghouse Elec. Supply Co.
For New Home Machine:
Seattle: Condon's Ben Franklin Store (R. B. Condon); S. Nelson, 715 Pine St. (1); Poole Elec. Co., 1116 Fourth Ave. (1).
Spokane: Nelson & Statler, Inc., 514½ Sprague St.
Bremerton: Mitchell Sales Co.
Everett: Ben L. Hardy, 1910 Aakes Ave.
Portland: Sharff & Sons, 837 S.W. Third Ave. (4); Roberts Bros.
Salem: George C. Will, 432 State St.
San Francisco: I. S. Cohen's Sons, 149 Turk St. (2); Economy Sew. Mach. Store, 2173 Mission St. (10).
Oakland: Hale Bros. Store (E. W. Ekstrom), Washington & 11th (7).
Merced: Mary L. Hutchinson, 323 17th St.
Hanford: M. E. Lewis.
Fresno: D. Schulman, c/o Famous Dept. Store.
Bakersfield: W. H. Hohansing.
Los Angeles: E. R. Brown, Fifth & Broadway.
Pasadena: New Home Sales Co., 341 N. Lake Ave.
San Diego: Jack Kingery, 1311 Fifth St.
Las Vegas: Nevada Elec. Co.
Namp, Idaho: G. B. Stone.
Salt Lake City: M & M Home Appl. Co., 123 E. Broadway.
Albuquerque: Riedling Music Co.
Gallup: S. P. Vidal & Co.
Las Cruces: The Myers Co.
Lordsburg: W. F. Ritter Lumber Co.

FRIGIDAIRE DIVISION, General Motors Corp., 300 Taylor St., Dayton, O.
District Offices:
(Frigidaire home appliances, com'l refrigeration, air conditioners)
Oakland: 1250 53d St. (8).
Los Angeles: 1031½ N. La Brea Ave. (38).
Distributors:
Seattle: Sunset Electric Co., P. O. Box 3148 (14).
Spokane: Jensen-Byrd Co., P. O. Box 2172 (8).
Portland: Sunset Electric Co., N.W. 10th Ave. & Glisan St. (9).
Salt Lake City: W. H. Bintz Co., P. O. Box 1350 (11).
Billings: Northwestern Auto Supply Co., 420 N. Broadway.

GAROD RADIO CORP., 700 Washington St., Brooklyn, N. Y.
(Garod radio)
Factory service only.

THE P. A. GEIER CO., 540 E. 105th St., Cleveland, O.
(Royal vacuum cleaners)
All distributors and dealers that sold Royal will service, or may be sent direct to factory.

GENERAL CONSTRUCTION CORP., Ormond Beach, Fla.
(Icette)
San Francisco: Wallace R. Lynn Co., 2048 Market St. (3).
Los Angeles: Wallace R. Lynn Co., 318 W. 15th St. (15).

GENERAL ELECTRIC CO., 1285 Boston Ave., Bridgeport, Conn.
(G-E appliances)
Rocky Mountain area serviced by Gen. Elec. Supply Corp.:
Denver: 1429 18th St.
Salt Lake City: 130 W. 2nd So.
Radios — Electronic Service & Supply Co., 115 E. Broadway.
Boise: 1210 Grove St.
Butte: 900 E. Front St.
Pacific Coast area—by appliances:
Radios—Vacuum Cleaners:
Serviced by G. E. Supply Corp.
Seattle: 1212 First Ave. So. (4).
Radios—Nick H. Foster, 2301 Fifth Ave. (1).
Spokane: S. 122 Monroe St.
Portland: 230 N. W. Broadway (9).
Radios—Saelen's Radio Service, 534 N.W. Broadway. (9).
San Francisco: 1201 Bryant St. (3).
Oakland: 204 Ninth St. (7).
Fresno: 1234 "O" St.
Los Angeles: 700 Turner St. (12).
San Diego: 205 W. Market St.
Phoenix: 441 W. Madison St.
Fans:
Serviced by G-E Supply Corp. in Cities listed for "Radios-Vacuum Cleaners." Also serviced by Graybar Electric Co. in Sacramento, San Francisco, Oakland, Fresno, Los Angeles, San Diego, Phoenix. In addition, serviced in:
Tacoma: Home Elec. Co., 1316 "A" St.
Salem: Eoff Elec. Co.
Home Laundry, Household Refrigerators, Ranges, Water Heaters, Dishwashers, Disposalls:
Seattle: G-E Supply, 1212 First Ave. So. (4); Refrigerators—Acme Refrig. Co., 2214 Fourth Ave. (1).
Spokane: G-E Supply, S. 122 Monroe St.
Portland: G-E Supply, 230 N.W. Broadway (9); Refrigerators—J. C. Stump Refrig. Co., 612 N.W. Davis St. (9).
San Francisco: Gen. Elec. Co. Appliance Service Center, 351 Bryant St. (7).
Oakland: G-E Supply, 204 Ninth St. (7).
Fresno: Valley Elec. Supply, Power Bldg.
Los Angeles: Gen. Elec. Co. Appliance Service Center, 701 Banning St.
Heating Devices—Sunlamps:
Seattle: Howell's Elec. Supply & Service Co., 522 Union St. (1).
Portland: Morrison's Elec. Service, S.W. 13th and Washington St. (5).
San Francisco: Gen. Elec. Co. Appliance Service Center, 351 Bryant St. (7).
Los Angeles: Gen. Elec. Co. Appliance Service Center, 701 Banning St.
Clocks:
Seattle: Ray D. Reid, 1417 4th Ave. Bldg. (1).
Spokane: Maxwell & Franks, First and Wall Sts.
Portland: B. W. Cobb Watch & Clock Shop, 220 S.W. Alder (4).
San Francisco: Calif. Elec. Service Station, 400 Mission St. (5).
Los Angeles: Calif. Elec. Service Sta., 630 W. 9th St. (15).
San Diego: J. F. Zweiner Elec. Co., 229 "B" St.
Phoenix: Vinson-Carter Elec. Co., 25 E. Adams St.

GENERAL SHAVER DIV. of Remington Rand Co., 2 S. Main St., Bridgeport, Conn.
(Remington Rand Shaver)
Remington Rand Service Stations:
Seattle: 1910 Fourth Ave. (1)
Spokane: W. 916 Riverside Ave.
Portland: 525 S.W. Pine St. (4).
San Francisco: 41 First St. (5).
Oakland: 2032 Broadway (12).
Los Angeles: 711 S. Olive St. (14).
San Diego: 2nd Floor, Bank of America Bldg.
Denver: 1525 Arapahoe St.
Salt Lake City: 47 W. So. Temple St.
Phoenix: 128 S Central Ave.
Tucson: 307 E. Congress St.
Albuquerque: 221 W. Copper Ave.

GIBSON REFRIGERATOR CO., Greenville, Mich.
(Gibson range and refrigerator)
Seattle: Seattle Hdwe. Co., 501 First Ave., S. (4).
Spokane: Spokane Paper & Stationery Co., S. 152 Jefferson St.
Portland: Elec'l Distributors, Inc., 525 N.W. 10th St. (9).
San Francisco: H. R. Basford Co., 425 Second St. (5).
Los Angeles: Graybar Elec. Co., 201 Santa Fe Ave. (12).
Denver: Austin Appliance Co., 414 15th St.
Salt Lake City: United Elec. Supply Co., 117 W. 4th St.
Phoenix: Graybar Elec. Co. 434 W. Madison St.
Billings: Billings Hdwe. Co.
Nampa, Idaho: McLain Hdwe. Co.

GREEN COLONIAL FURNACE CO., 322 S.W. 3d St., Des Moines 7, Iowa.
(Green Colonial winter air conditioning equipment)
Factory service only.

THE GRISWOLD MFG. CO., Erie, Pa.
(Griswold com'l cooking equipment & utensils)
Write to factory for advice.

HAAG BROS CO., 1616 N. Adams St., Peoria 3, Ill.
(Haag washers)
Factory service only.

HAMILTON BEACH CO., Div. of Scoville Mfg. Co., Racine, Wis.
(Hamilton Beach home appliances and soda fountain line)
Seattle: Elec'l Engineering Co., 110 Marion St. (4).
Spokane: Maxwell & Franks, 619 First Ave.
Portland: Morrison Elec. Service, 1236 S.W. Washington (5).
San Francisco: Will M. Aronson Co., 955 Folsom St. (7).
Los Angeles: Elec. Lighting Supply Co., 216 W. Third St. (13).
San Diego: J. F. Zweiner Elec'l Co., 229 "B" St.
Denver: Midwest Elec. Wiring Co., 323 W. Colfax Ave.
Salt Lake City: Time & Instrument Co., 222 Dooly Bldg.

HAMMOND INSTRUMENT CO., 2915 N. Western Ave., Chicago, Ill.
(Hammond electric clocks)
Portland: B. W. Watch & Clock Shop, 226 Alder St. (4).
San Francisco: Calif. Elec. Construction Co., 400 Mission St. (5).
Los Angeles: American Clock Co., 315 W. 5th St. (13).

HOBAR COMPANY, THE, 208 Fifth Ave., New York 10, N. Y.
(Twinface clocks)
Factory service only.

THE HOOVER CO., North Canton, O.
(Hoover cleaners)
Factory branch stations (prepared to render any service; also have service salesmen and agents throughout western states; parts are not available to the trade):
Seattle: 621 Fourth Ave. (4).
Tacoma: 121 Perkins Bldg.
Spokane: 514 Metals Bldg.
Portland: 19 N.E. Broadway (12).
San Francisco: 468 Turk St. (2).
Oakland: 160 A Grand Ave. (12).
Los Angeles: 3006 W. 7th St. (5); 3241/2 S. La Brea (36).
Long Beach: 1209 Pine Ave.
Pasadena: 35 S. Raymond.
San Diego: 524 "F" St.
Denver: 2217 E. Colfax Ave.
Salt Lake City: 325 Brooks Arcade

HORTON MFG. CO., 731 Osage St., Fort Wayne, Ind. (mailing address Box 477, Fort Wayne 1, Ind.)
(Horton washers and ironers)
Seattle: Appliance Parts & Service, 216 Stewart St. (1).
San Francisco: Washing Machine Parts Co., 123 10th St. (3).
Los Angeles: Electrical Appliance Service Corp., 726 Venice Blvd. (15); Washing Machine Parts Co., 1241 S. Hope St. (15).
*Denver: Hendrie & Bolthoff Mfg. & Sup. Co., 1635 W. 17th St.
*Pocatello, Idaho: Billmeyers, Inc.
*distributors, do not stock replacement parts but accept orders for factory attention.

HURLEY MACHINE DIV., Electric Household Utilities Corp., Cermak Road & 54th Ave., Chicago 50, Ill.
(Thor washers and ironers)
Factory parts depots and service stations—Branches:
Seattle: Hurley Machine Div., 818 First Ave. So. (4)
Portland: Hurley Machine Div., 231 E. Burnside (14)
San Francisco: Thor Pacific Co., 1343 Howard St. (3)
Los Angeles: Thor Pacific Co., 1132 S. Grand Ave. (14).
Distributors:
Seattle: Appliance Parts & Service Co., 214 Stewart St. (1); Graybar Elec. Co., Inc., King & Occidental Sts. (4).
Spokane: Graybar Elec. Co., Inc., 152 E. Post St.
Portland: W. L. May Co., 24 Broadway (9).
Denver: B. K. Sweeney Elec'l Co., 1601 23rd St.
Salt Lake City: W. H. Bintz Co., 433 W. Third S. St.
Pueblo: Ingle's Washing Machine Exchange & Repair, 417 N. Santa Fe Ave.

INGERSOLL, DIV. of WATERBURY CLOCK CO., 31 Cherry Ave., Waterbury 91, Conn.
(Ingersoll, Kelton, Connecticut and Waterbury clocks)
Factory service only.

INTERNATIONAL APPLIANCE CORP., 1027 Metropolitan Ave., New York.
(Broilking appliances)
San Francisco: Will M. Aronson, 955 Folsom St. (7).
Los Angeles: Elec. Lighting Supply Co., 216 W. Third St. (13).

IRON FIREMAN MFG. CO., 3179 W. 106th St., Cleveland, Ohio.
(Iron Fireman automatic heating and power equipment)
Factory: 4784 S.E. 17th Ave., Portland (2).

IRONRITE IRONER CO., THE, 38 Piquette Ave., Detroit, Mich.
(Ironrite Ironer)
Seattle: Harper-Meggee, Inc., 960 Republican St. (9).
Spokane: Harper-Meggee, Inc.
Portland: Harper-Meggee, Inc., 17th & Irving. (9).
Oakland: Gordon E. Wilkins Ironers, Inc., 3100 Telegraph Ave. (9).
Los Angeles: Elec'l Appliance Service Corp., 826 W. Venice (15).

KEYSTONE SILVER INC., 509 W. 34th St., New York 1, N. Y.
(Keystoneware percolators)
Factory service only.

THE KITCHENAID DIVISION, The Hobart Mfg. Co., Pennsylvania Ave. & Simpson St., Troy, Ohio.
(KitchenAid mixers and coffee mills)
Seattle: C. L. Dick, 2208 Second Ave. (1).
Portland: J. W. McCrea, 239 N.W. 14th Ave. (9).
San Francisco: W. E. Pixley, 929 Mission St. (3).
Los Angeles: H. M. Benner, 410 S. Los Angeles St. (13).
Salt Lake City: Geo. A. Pruatt, 24 S.W. Temple St.

LACO OIL BURNER CO., Griswold, Iowa.
(Laco Oil Burners)
Factory service only.

LANDERS, FRARY & CLARK, New Britain, Conn.
(Universal appliances)
Service on all appliances:
Seattle: Elec'l Engineering Co., 110 Marion St. (4).
Spokane: Brown-Johnston Co., N. 118 Lincoln St.
Yakima: Yakima Hdwe. Co., 715 12th St., N.W.
San Francisco: Universal Elec. Appliance Co., 1265 Folsom St. (3).
Salt Lake City: Strevell Patterson Hdwe. Co., 124 S.W. Temple St.
Phoenix: Vinson-Carter Co., 25 E. Adams St.
Service on vacuum cleaners only:
Portland: Morrison Elec. Service, 1236 S.W. Washington St. (5). Stark Vacuum Cleaner Co.
Los Angeles: Utility Repair Shop, 1928 W. 76th St. (5).
Denver: Midwest Elec. Wiring Co., 323 W. Colfax Ave.

MANNING, BOWMAN & CO., Pratt & Miller Sts., Meriden, Conn.
(Manning-Bowman or M-B heating appliances)
Service and parts available with the exception of heating pad repairs:
Seattle: Howell's Elec. & Supply Co., 522 Union St. (1).
Spokane: Maxwell & Frank, First at Wall St.
Portland: Morrison Elec. Supply Co., 1236 S. Washington St. (5).
San Francisco: Manning-Bowman Service Sta., 150 Post St. (8).
Los Angeles: Motor & Machinists Supply Co., 230 S. San Pedro St. (12).
San Diego: J. F. Zweiner Elec'l Co., 229 "B" St.
Denver: Hendrie & Bolthoff Mfg. & Supply Co., 1635 17th St.
Salt Lake City: Time & Instrument Co., 222 Dooly Bldg.
Phoenix: Vinson Carter Elec. Co., 25 E. Adams St.
Dallas: Emerson Elec. Co., 2000 Live Oak St.

MARKEL ELEC. PRODUCTS, INC., 145 Seneca St., Buffalo, N.Y.
(Heetaire electric heaters)
Factory service only.

THE MAYTAG COMPANY, Newton, Iowa.
(Maytag washers)
Distributors and Branch Offices:
Portland: Maytag Northwest Co., 1136 N.W. Hoyt St. (9), (Wash., Ore., Idaho, Utah, western Nev.)
Los Angeles: Maytag West Coast Co., 1225 W. Ninth St., (15). (Calif., eastern Nev., Hawaiian Is.)
Colorado Springs: Maytag Rocky Mt. Co. (Colo., Wyo., N.M., Ariz.)
Montana: The Maytag Co., 515 Washington Ave., N., Minneapolis, Minn.

MERRYWAY COMPANY, Poughkeepsie, N. Y.
(Merryway elec. food preparer)
San Francisco: Dohrmann Hotel Supply Co., 984 Mission St. (3). (for Western states and Hawaii)

THE METAL WARE CORP., Two Rivers, Wis.
(Empire and Empco domestic electric appliances)
Seattle: Elec'l Engineering Co., 110 Marion St. (4).
Spokane: R. T. Carr Sales Co., 919 W. First Ave.
Portland: Morrison Elec. Service, S.W. Washington at 13th (5).
San Jose: Century Elec. Co., 18 E. San Antonio St.
San Diego: J. F. Zwiener Elec. Co., 229 "B" St.

McGRAW ELECTRIC CO., Elgin, Ill.
(Toastmaster toasters and waffle bakers—commercial and domestic; Toastmaster roll and food warmers—commercial)
Seattle: Appliance Parts & service Co., 214 Stewart St. (1).
Spokane: Maxwell & Franks, First Ave. at Wall St.
Portland: Bressie Elec. Co., 909 S.W. Fifth Ave. (4).
San Francisco: Radelfinger Bros., 544 Natoma St. (3).
Los Angeles: McGraw Elec. Co., 316 E. 3rd St., (13).
San Diego: J. F. Zweiner Elec'l Co., 229 "B" St.
Denver: Midwest Elec. Wiring Co., 323 W. Colfax Ave. (domestic only); E. S. Hawkins Elec'l Service, 426 S. Downing St. (com'l only).
Honolulu: Hawaiian Elec. Co. (distributor for appliances and parts)
(In all cases old parts should be returned to service station or distributor when new parts are requested).

MOTOR PRODUCTS CORP., Deepfreeze Div., 2301 Davis St., North Chicago, Ill
(Deepfreeze industrial chilling equipment)
Factory service only.

NASH-KELVINATOR CORP., 14250 Plymouth Road, Detroit, Mich.
(Kelvinator refrigerators, elec. ranges, com'l refrigerating equip.; Leonard refrigerators)
Seattle: Harper-Meggee, Inc., 960 Republican St. (9).
Spokane: Harper-Meggee, Inc., S. 163 Lincoln.
Portland: Harper-Meggee, Inc., 15th & Irving (9).
Oakland: Nash-Kelvinator Sales Corp., 1705 E. 12th St. (6).
Los Angeles: Nash-Kelvinator Sales Corp., 1620 E. 7th St. (21)
Denver: Nash-Kelvinator Sales Corp., 1147 Broadway.
Salt Lake City: Flint Distr. Co., 316 W. 2nd So. St.
Phoenix: Elec'l Equipment Co., of Ariz., 424 N. Central Ave.
Billings: Taylor Refrigeration & Appl. Co., 2714 Montana Ave.
El Paso: Car Parts Depot, Inc., 712 Texas St.
Albuquerque: Charles Ilfeld Co., 200 N. First St.
Roswell: Wilmot Hdwe. Co., 115 N. Main St.

NATIONAL ENAMELING & STAMPING CO., 270 N. 12th St., Milwaukee, Wis.
(Nesco appliances)
Seattle: City Elec. & Fixture Co., 1022 3rd Ave. (4).
Spokane: Maxwell & Franks, 1st Ave. at Wall St.
Portland: Bressie Elec. Co., 909 S.W. 5th Ave. (4).
San Francisco: Will M. Aronson Co., 955 Folsom St. (7)
Los Angeles: Elec'l Appliance Service Corp., 726 W. Venice Blvd. (15).
Denver: Midwest Elec. Wiring Co., 323 W. Colfax.
Salt Lake City: Time & Instrument Co., 222 Dooley Bldg.
Dallas: Douglass Elec. Appliance Co., 1323 W. Davis.

NATIONAL STEEL CONSTRUCTION CO., 500 Myrtle St., Seattle 8, Wash.
(National and Columbia elec. water heaters)
Factory service only.

NAXON UTILITIES CORP., 2101 W. Walnut St., Chicago 12, Ill.
(Naxon, Beanery, Vitamin Crock Krock Cooker, Hott-Watt, Autogriddle, Lustro-griddle, Broiler Server, Broileroaster, Broilerange)
Portland: W. L. May Co., 24 N.W. Broadway. (9).
Los Angeles: Elec'l Appliance Service Corp., 726 W. Venice. (15).

NORGE DIVISION, Borg-Warner Corp., 670 E. Woodbridge St., Detroit, Mich.
(Norge domestic & com'l refrigerators, gas & elec. ranges, washers, oil burning space heaters, and other appliances)
Seattle: Fifth Ave. Parts & Serv. Co., 125 First Ave., N. (9).
Spokane: Columbia Elec. & Mfg. Co., 123 S. Wall St.
Portland: W. G. Carey, Jr., 326 N.W. 6th Ave. (9).
San Francisco: Leo J. Meyberg Co., 70 Tenth St. (3).
Los Angeles: Leo J. Meyberg Co., 2027 S. Figueroa St. (7).
El Centro: Imperial Hdwe. Co.
Denver: Auto Equipment Co., 14th & Lawrence Sts.
Salt Lake City: Salt Lake Hdwe. Co., 103 N. 3d W.
Boise: Salt Lake Hdwe. Co.
Billings: Midland Implement Co., 2303 Montana Ave.
Great Falls: Midland Implement Co.
El Paso: Albert Mathias & Co.
Albuquerque: Albuquerque Norge, Inc., 218 N. 4th St.
Honolulu: Easy Appliance Co., 91 S. King St.

OHIO ELECTRIC CO., 145 W. 45th St., New York City.
(Ohio, Tuec Sanitator, DeLuxe Cylinder vacuum cleaners)
Factory service only.

ONE MINUTE WASHER CO., Kellogg, Iowa.
(One Minute washer)
Seattle: Appliance Parts & Service Co., 214 Stewart St. (1).
Portland: W. L. May Co., 122 S.W. 5th Ave. (4).
Los Angeles: Washing Machine Parts Co., 1241 S. Hope St. (15).
Denver: Ray Jones Wash. Mach. Parts Co., 376 S. Broadway.
Salt Lake City: Claude Dodge, 153 Broadway.

PRIMA washers and ironers (See Automatic Washer Co.)

PROCTOR ELEC. CO., 3d St. & Hunting Park Ave., Philadelphia 40, Pa.
(Proctor elec. appliances)
Seattle: City Elec. & Fixt. Co., 1022 Third Ave. (4).
Spokane: Maxwell & Franks, First & Wall Sts.
Tacoma: The Ajax Elec. Co., 746 Market St.
Walla Walla: Elec. Supply & Fixt. Co.
Portland: Bressie Elec. Supply Co., 909 S.W. 5th Ave. (4).
Eugene: C & S Elec. Co., 1070 Willamette St.
Medford: Trowbridge & Flynn Elec. Co., 214 W. Main St.
San Francisco: Calif. Elec'l Constr. Co., 400 Mission St. (5).
Sacramento: Lamb's Elec. Shop, 627 "L" St.
Oakland: Paul Morrison, 278 12th St.
Fresno: Electric Motor Shop, 1926 Kern St.
Bakersfield: Urner's, 2006 Chestnut Ave.
Los Angeles: Elec'l Appliance Service, 726 W. Venice Blvd. (15).
Long Beach: Dean & Hoffman Co., 221 American Ave.
Santa Barbara: California Electric Co., 30 E. Victoria St.
San Diego: J. F. Zweiner Elec'l Co., 229 "B" St.
Denver: Midwest Elec. Wiring Co., 323 W. Colfax Ave.
Salt Lake City: Time & Instrument Co., 222 Dooley Bldg.

Phoenix: Anglin Barber & Beauty Sup. Co., 206 W. Washington St.
Reno: Moltzen & Fitch Elec. Co., 275 S. Virginia St.
Butte: Radio Eng'g & Service, 219 W. Park St.
Boise: C. C. Anderson Stores Co.
Tucson: Grabe Elec. Co., 26 E. Congress St.
Dallas: Douglass Elec. Appliance Co., 1323 W. Davis St.
El Paso: Hays Elec. Service, 103 Montana St.
Houston: Standard Mercantile Co., 1923 Washington St.

REMINGTON RAND CO. — See General Shaver Div.

REXAIR, INC., 319 Fisher Bldg., Detroit 2, Mich.
(Rexair cleaner)
Repair Service Stations:
Los Angeles: 3906 Beverly Blvd. (4) (Calif., Ore., Ariz., Nev.)
Billings: 2109 Poly Drive.
Kansas City: 503 Porter Bldg. (N.M. and Colo.)
Honolulu: Herman Luis, Box 2608.

ROBERTS & MANDER STOVE CO., 237 Jacksonville Rd., Hatboro, Pa.
(Quality gas and electric ranges)
Factory service only.

RUTENBER ELECTRIC CO., Marion, Ind.
(Marion electric range, heating & cooking appliances)
Seattle: Globe Electric Co., 307 First Ave., S. (4).
Spokane: R. T. Carr Sales Co.

SAMSON UNITED CORP.—RED SEAL APPLIANCE CORP., 1700 University Ave., Rochester, N. Y.
(Samson, Red Seal, Safe-Flex, Brighton Sales, Duro, Seneca Co.)
Monroe Service Co., 1700 University Ave., Rochester only.

SCHICK SERVICE, INC., 45 Garden St., Stamford, Conn.
(Schick shaver)
Branch Offices:
Seattle: 701 Republic Bldg. (1).
San Francisco: 787 Monadnock Bldg. (5).
Los Angeles: 443 S. Spring St. (13).
Denver: 501 Colorado Bldg.
Parts not supplied separately, complete shaver should be sent for attention.

THE SCOTT & FETZER CO., W. 114th & Locust Ave., Cleveland, O.
(Kirby vacuum cleaners)
Dist. Office (H. Reznichek): 2980 S. W. Fairview Ave., Portland 12, Ore.
(Sales, service and parts for all western states)
Distributors:
Seattle: Kirby Co. of Seattle, 2807 Franklin Ave. (2).
Spokane: Kirby Vacuum Cleaner Co., 177 S. Washington.
Tacoma: Kirby Co. of Tacoma. 608 N. Puget Sd. Ave.
Bellingham: Northwest Kirby Co., 3733 Beal St.
Walla Walla: Kirby Co. of Walla Walla, 1207 Figueroa St.
Portland: Kirby Co., 514 N. E. Jarrett (11) (N. Portland & S. W. Wash.)
Salt Lake City: Towler Distr. Co., 1628 S. 3d E. St.
Idaho Falls: Kirby Co. of E. Idaho, 240 S. Water Ave.
Great Falls: Kirby Vacuum Cleaner Co., P.O. Box 1484.

SETH THOMAS CLOCKS, Thomaston, Conn.
(Seth Thomas clocks)
San Francisco: Schloss Mfg. Co., 540 Mission St. (5).

SHEPLER MFG. CO., 1312 Sheffield St., N. S., Pittsburgh, Pa.
(Radia heaters and fans)
Los Angeles: Electric Lighting Supply Co., 216 W. 3d St. (13).

THE SILEX COMPANY, 80 Pliny St., Hartford, Conn.
(Silex coffee maker)
Seattle: Elec'l Engineering Co., 110 Marion St. (4).
Spokane: Maxwell & Franks, 619 1st Ave.
Portland: Morrison Elect. Co., S.W. Washington at 13th (5).

SINGER SEWING MACHINE CO., 149 Broadway, New York, N.Y.
(Singer household iron)
San Francisco: Calif. Elec'l Construction Co., 400 Mission St. (5).

SON-CHIEF ELECTRICS, INC., Winsted, Conn.
(Son-Chief, Speed-Master, Speed-O-Matic appliances)
Seattle: Howell's Elec. & Supply Co., 522 Union St. (1).
San Francisco: Will M. Aronson, 955 Folsom St. (7).
Los Angeles: State Appliance Co., 451 E. 4th St. (13).

STAR MFG. CO., INC., 6300 St. Louis Ave., St. Louis, Mo.
(electric appliances)
Factory service only.

STARR COMPANY-GENNETT & SONS, 1 Main St., Richmond, Ind.
(Starr-Freeze, Gennett refrigerators)
Factory service only.

STERN-BROWN, INC., 42-24 Orchard St., L. I. City, N. Y.
(Superstar small appliances)
Seattle: Sound Electric Co., 311 Madison St. (4).
San Francisco: Radelfinger Bros., 544 Natoma St. (3).
Los Angeles: Elec'l Appliance Service Corp., 726 W. Venice Blvd. (15).
Salt Lake City: Wolters Elec. Co. 238 S. State St.

SUNBEAM ELEC. MFG. CO., Evansville, Ind.
(Coldspot electric refrigerator)
Serviced through Sears, Roebuck & Co. stores exclusively.

THE SWARTZBAUGH MFG. CO., 1336 W. Bancroft St., Toledo 6, Ohio.
(Everhot appliances)
Seattle: City Elec. & Fixt. Co., 1022 Third Ave. (4).
Portland: Morrison Elec. Co., S.W. Washington at 13th (5).
San Francisco: Calif. Elec. Service Stations, 400 Mission St. (5).
Los Angeles: Motor & Machinists Sup. Co., 230 S. San Pedro. (12).

THERMADOR ELEC'L MFG. CO., 5119 S. Riverside Dr., Los Angeles 22, Calif.
(Thermador heat-fans)
San Francisco: Calif. Elec. Service Station, 400 Mission St. (5).
Los Angeles: Thermador factory service.

THE TOASTSWELL CO., 620 Tower Grove Ave., St. Louis, Mo.
(Toastswell toasters)
Los Angeles: Anderson Repair Service, 616 Maple Ave. (14).

THE TORK CLOCK CO., INC., Mt. Vernon, N. Y.
(Tork clocks)
Seattle: H. M. Sayers, 1101 Eastlake Ave. (9).
San Francisco: Geo. H. Curtiss, 540 McAllister St. (2).
Los Angeles: A. R. Slimmon Co., 443 E. 3d St. (13).
Salt Lake City: Stevens Sales Co., 41 Post Office Place.

HAROLD E. TRENT CO., Leverington Ave. & Wilde St., Philadelphia, Pa.
(Trent electric heaters, furnaces, ovens, hot plates & kettles)
Factory service only.

VIDRIO PRODUCTS CO., 134 W. 54th St., Chicago, Ill.
(Sterro, Baby Grande and Master Grande portable washers; Waldorf Liqui-Mixer; Air Chief Fans; De Luxe hair dryers)
Factory service only and limited to available parts.

VOSS BROS. MFG. CO., Davenport, Ia.
(Voss washers)
Seattle: Appliance Parts & Service Co., 214 Stewart St. (1).
Spokane: Spokane Washer Co., 20 N. Washington St.
Portland: W. T. Dyke Service Co., 122 S.W. 5th Ave (4).
San Francisco: Washing Machine Parts Co., 123 10th St. (3).
Los Angeles: Elec. Appliance Parts Service Corp., 726 W. Venice Blvd. (15).

WAAGE MFG. CO., 2424 N. Sacramento Ave., Chicago 47, Ill.
(Waage 3-heat iron)
Seattle: Elec'l Engineering Co., 110 Marion St. (4).
Portland: Morrison Elec. Co., S.W. Morrison at 13th. (5).
Los Angeles: Electric Ltg. Supply, 216 W. 3d St. (13).

WARREN TELECHRON COMPANY, Ashland, Mass.
(Telechron elec. clock)
Seattle: City Elec. & Fixt. Co., 1022 Third Ave. (4).
Spokane: Maxwell & Franks, 619 First Ave.
Portland: B. W. Cobb Watch & Clock Shop, 226 Alder St. (4).
San Francisco: Calif. Elec. Service Station, 400 Mission St. (5).
Los Angeles: Calif. Elec. Service Station, 1518 W. 7th (5)
San Diego: J. F. Zweiner Elec. Co., 229 "B" St.
Denver: Midwest Elec. Wiring Co., 323 W. Colfax Ave.
Salt Lake City: Time & Instrument Co., 222 Dooly Bldg.
Phoenix: Vinson-Carter Elec. Co., 25 E. Adams St.
Honolulu: Hawaiian Elec. Co., P.O. Box 2750 Merch. Dept.

WESIX ELEC. HEATER CO., 390 First St., San Francisco 5, Calif.
(Wesix heaters)
Factories:
Seattle: 3221 Western Ave. (1).
Portland: 103 14th N.W. (9).

FRACTIONAL HORSEPOWER MOTORS AND PARTS

Motor repair shops in various localities are often designated as agents for various lines of motors and these include fractional horsepower motors. Full list of these could not be obtained. The following, however, may be of assistance:

MOTOR EXCHANGE AND REPAIR SERVICE

General Electric Motors—General Electric Service Shop, 351 Bryant, San Francisco (7)
Westinghouse Motors—Westinghouse Electric & Manufacturing Co., 5915 Green St., Emeryville, Calif.

MOTOR REPAIR PARTS

for Apex, Baldor, Brown-Brockmeyer, Bodine, Century, Delco- Frigidaire, Diehl-Singer, Duro, Emerson, Fairbanks Morse, General Electric, Howell, Ilg, Kimble, Kingston-Conley, Leland, Master, Marathon, Ohio, Peerless, Robbins & Myers, Reynolds, Sunlight, Wagner, Westinghouse.
L. L. Burror, 308 12th St., Oakland (7). (Has large stocks of parts and knowledge of makes, interchangeability and changeover possibilities.)
Parts may be obtained in some cases from local agents or factory representatives.

REPAIR SERVICE

for Delco Frigidaire and Sunlight Motors, and possibly other makes (send letter to inquire)
United Motor Service, Inc., 870 O'Farrell, San Francisco (9).

San Francisco: 390 1st St. (5).
Los Angeles: 2424 E. 8th St. (21)

WESTINGHOUSE ELEC. & MFG. CO., Mansfield, Ohio.
(Westinghouse appliances)
Serviced by Westinghouse Elec. Supply Co.:
Seattle: 1051 First Ave. (4).
Spokane: 152 S. Monroe St.
Tacoma: 1115 "A" St.
Portland: 134 N.W. 8th Ave. (9).
San Francisco: 260 5th St. (3).
Oakland: 10th & Alice Sts. (7).
Sacramento: 719 "K" St.
Los Angeles: 905 E. 2nd St. (12).
San Diego: Elec. Supplies Distr. Co., 435 2nd Ave.
Salt Lake City: 235 W. S. Temple St.
Phoenix: 315 W. Jackson St.
Butte: 50 E. Broadway
Reno: H. E. Saviers & Son, Inc., 2nd & West Sts.

WHITE SEWING MACHINE CO., 1231 Main Ave., Cleveland 1, Ohio.
(White and Domestic sewing machines)
Department stores where service and repair work may be obtained:
Seattle: The Bon Marche
Spokane: The Crescent
Portland: Meier & Frank Co.
San Francisco: The Emporium, 835 Market St. (3); Raphael Weill & Co., Sutter & Grant (8).
Oakland: H. C. Capwell & Co., 20th & Broadway (12); Capwell, Sullivan & Furth, 14th & Clay Sts. (12).
San Jose: L. Hart & Son Co.
Fresno: E. Gottschalk & Co.
Los Angeles: The May Co., 801 S. Broadway (14); Broadway Department Store.
Long Beach: Walker's Long Beach, Inc.
Denver: The May Company.
Honolulu: White Sewing Mach. Agency, 1112 Bethel St.

EDWIN L. WIEGAND CO., 7500 Thomas Blvd., Pittsburgh, Pa.
(Chromalox elec. htg. units; Heatflo elec. range top burners)
Serviced by Montgomery Bros.:
Seattle: 911 Western Ave. (4).
Portland: 2333 N.W. Westover Rd. (10).
San Francisco: 61 Fremont St. (5).
Los Angeles: 420 S. San Pedro St. (13).

WILLIAMS OIL-O-MATIC HEATING CORP., 1201 E. Bell St., Bloomington, Ill.
(Williams Oil-O-Matic water heaters & low and high pressure oil burners)
Seattle: Pacific Coast Coal Co., 4521 Leary Way (7).
Spokane: J. F. Babcock, 218 N. Division St.
Bellingham: A. J. Blythe Plumb. & Htg. Co., 1313 Railroad Ave.
Walla Walla: W. R. O'Rourke Plumb. & Htg. Co., 109 S. Second St.
Wenatchee: Morris Hdwe. Co., 23 Wenatchee Ave.
Portland: Pacific Coast Coal Co., 306 N.W. Broadway (9); Power Plant Eng'g Co., 4069 N.E. Union Ave. (12).
Salem: T. M. Barr, 164 S. Commercial St.
Eugene: L. P. Curtsinger, 1027 W. Broadway.
San Francisco: E. A. Cornely, Inc., 1452 Bush St. (9).
Oakland: Cooks Oil Co., 1350 Powell St. (8).
Sacramento: Rotary Oil Burner Co., 1625 N. "C" St.
Fresno: California-Fresno Oil Co., 3080 Golden State Highway
Santa Barbara: Ott Hardware Co., 727 State St.
Salt Lake City: Red Feather Oil Co., 204 W. 17th S.
Reno: Savage & Son, Inc., 628 S. Virginia St.
Missoula: Missoula Mercantile Co.

Home Study Course

G-E initiates new service training program

Supplementing its appliance service training classes, General Electric Co. has made available to dealers and service men a new correspondence course for home study. The original classes begun in June of 1942 (see ELECTRICAL WEST, June 1942, p. 72) have been continued. To supplement these a very complete appliance service handbook has been prepared by the Product Service Division for service shop personnel. Furthermore, since much of the instruction is given by means of sound slide films, these are made doubly effective by giving to each person attending the classes a book in which is reproduced each of the pictures in the sound slide film together with a portion of the talk pertinent to that picture. This forms a permanent handbook of methods for servicing various parts of the appliances covered.

The new correspondence home study course is designed for old-timers as a refresher course, yet is elemental enough so that a beginner can learn the fundamentals as he goes along in it. It is a twelve-lesson course, at two-week intervals, and has begun with the subject of refrigeration. Later on other products will be treated similarly. According to R. J. Kern, who directs the educational work, these courses are not confined to the company's own dealers nor is the information limited in its usefulness to the company's products. Utility service personnel and independent service shops can profit by it.

Other supplementary informational material are a magazine *The Product Man* and occasional literature of other types.

The company has established a second G-E appliance service center at 212 N. Vignes St., Los Angeles, in charge of W. K. White. The original one at 351 Bryant St., San Francisco, is in charge of R. J. Kern. Both of these are factory operated and equipped to take care of complete reconditioning of refrigeration units, ranges, etc.

● COMPLIMENTING ELECTRICAL APPLIANCES for having "what it takes," the Bureau of Radio and Electrical Appliances of San Diego conducts a subtle educational campaign to the public on the care of precious appliances to make them last. It offers the free booklet *How to Care for or Fix Your Home Appliance* and then advises that "if the unexpected happens," although all appliance dealers are snowed under they will do their best to take care of them for a person. In its latest bulletin the bureau also called a meeting Aug. 12 concerning the rationing of gas ranges, coal oil and wood burning equipment and presents the new oil heater restrictions. The refrigerator quotas for the territory have been used up and electric ranges are badly needed as well as water heaters. Gas water heaters seem to be available under an amendment to L-185, for replacement of obsolete equipment.

● CONSERVICE SCHOOLS of Westinghouse Electric Supply Co. moved over to the Rocky Mountain region during the past month and were held in the Salt Lake territory. There they were supervised by Joe Marine, Salt Lake district service manager, and Walter Schanz, field representative of the manufacturing company. John Longdon, Salt Lake district manager of Wesco, was host to the service men attending the various schools.

● HOTPOINT has issued a 32-page reference on food preservation by various methods, including pressure cooker, water bath, oven processing, dehydration, brining and sharp freezing. Instructions are included for fruits, berries, vegetables, meats and fowl. Written for the novice as well as the experienced, the booklet includes charts covering time and temperatures and is cross-indexed for quick and easy use. Titled *Home Canning by Hotpoint*, the manual is available at $5 per hundred, f.o.b. Chicago, from the Hotpoint advertising department.

● HOW TO MAKE A HOME FRUIT AND VEGETABLE DEHYDRATOR is told the customers of Southern California Edison Co. Ltd. in a broadside just issued by its commercial and advertising department. Under the direction of H. C. Rice, manager of domestic sales, tests were made of the new design of dehydrator which can be built at home from available materials. Five 200-watt lamps or a space heater can be used as a heat source.

● A WARTIME EDUCATIONAL SERVICE for home economists, teachers and students, written around electric cooking, and a series of advertising messages in architectural magazines to acquaint builders with the need for providing adequate electrical facilities in all new houses have been started by the Electric Range Section of the National Electrical Manufacturers' Assn.

● CONTINENTAL BATTERY AND ELECTRIC SUPPLY CO. was formerly co-owned by E. A. Jensen, of Preston, who recently purchased the entire business and consolidated it with the Gamble store in that city.

Electronic Service & Supply Co. in Salt Lake City has been designated by General Electric Supply Co. for handling radio repairs in that territory. Located at 115 E. Broadway, it is operated by Gay Martin and William Lisonbee, co-owners. Martin (shown at extreme left above) was with G-E Supply Corp. for 15 years and Lisonbee (foreground) was with Strickland's in Long Beach for eight years. Others are Ray Jaeger (second from left) and Robert Harmon

ELECTRICAL WEST

McGRAW-HILL COMPANY OF CALIFORNIA
68 POST ST. SAN FRANCISCO . 4

The all-industry magazine of progress, established 1887 and incorporating the "Electrical Journal," "Journal of Electricity, Power & Gas" and "Journal of Electricity." Contents Copyrighted

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Conservation Not Power Shortage

DISTASTEFUL as is the voluntary electricity conservation program which starts September 15, it has its compensating features. For one thing it might have been engineered and ordered by those New Deal forces which have been badgering the electric light and power companies for the last ten years. Also it might have been the outcome of a power shortage which really would reflect discredit to the utilities.

As matters stand, it is voluntary, even though it may make the industry look silly after saying for the last three vital years that there is no power shortage and there will be none. If the public emphasis can be placed on the fact that it is part of a cross-the-boards program to conserve coal, oil and transportation facilities, then the industry can earn some public goodwill as a willing co-operator.

Initially here in the West there was a feeling that those companies which are enforcing the security brownout along the coast had made a sufficient contribution to conservation. While it was admitted that their sacrifice was great, for the sake of unity and industry solidarity they were convinced that full support of the new voluntary program was desirable.

So for the duration the industry's sales story goes into reverse. No more is it "Electricity Is Cheap—Use It Freely." Now it is "Electricity Is Vital to the War—Use It Wisely—Conserve."

Maintenance Scale

TOGETHER the contractors and the union are working on a touchy old subject. As the gigantic construction program for war production and the erection of camps and military installations tapers off sharply the economic necessity which long ago forced many small contractors to abandon their businesses for the duration is reaching the big contractors and, of course, their electrical crews. There must be developed some new source of business or contractors and wiremen will have to close up shop and be absorbed in the big war production labor pool somewhere.

Therefore a field which construction wage scales made impossible for contractors to enter competitively is being investigated for its possibilities for both contractors and electricians. This is the field of maintenance of plant electrical systems and equipment. The barrier previously was that the industrial plant, because of steady work on a regular pay roll, was able to get its maintenance electricians from the union at a lower scale of pay than that required of the contractors in the hiring of construction workers.

Now efforts are being made in the West to develop comparable wage scales for the contractor when he does maintenance work, in order to permit him to seek this kind of business. With an equal wage scale it will be up to him to develop efficiencies in the handling and management of maintenance work which will put him in position to compete with the plant's own department. He has developed such efficiencies in competitive construction contracting. Another case in which incentive begets results.

No Time for Complacency

ANYONE with a grain of horse sense must appreciate that the major battles of the war lie still ahead. How anyone can be complacent or let-down in the face of that knowledge is enigmatical. Certainly the meager victories of recent weeks do not warrant any feeling that the end is in sight, and victory is simply a matter of weeks.

On the battlefront and on the homefront the big fights lie ahead and not behind. In Sicily Allied troops met and defeated less than seven per cent of the total Axis divisions based in Europe. The percentage of Jap troops which have thus far faced our guns is even smaller.

At home the battle of inflation is far from over.

Production lags; it is reported that military plans have been affected by the drop in war production. The manpower problem is far from solved. There is labor strife. Transportation facilities stagger under tremendous loads and threaten to break down for want of maintenance.

Even though we all may be convinced that the end of the war is near, we cannot be complacent. If management and labor both would but realize that an all-out effort now might quicken the victory by weeks or even months, there would be no more let-downs or slowdowns.

Let's be realistic in the electrical industry.

Postwar Engineering Planning

RECENTLY a group of utility engineers complained that they apparently had no place in postwar planning, that their work was largely routine. Nothing could be farther from the facts. Engineers have definite postwar planning responsibilities and opportunities. It is not too early now to begin working on them.

The whole subject of substitutions and modifications occasioned by material shortages is one that should be examined closely for its postwar implications. How many of the substitutions should be retained? Do some of them indicate other opportunities for departure from what has been considered standard practice? Many changes have been made in codes and standards because of material limitations. Should we return to the old provisions or keep the new once the war is ended? Operating procedures have been simplified because of manpower limitations. Have the changes been good and are they worth retaining?

Along with victory will come the release of large blocks of power now used in strictly war industries. This power will be available for use by other customers. Will present distribution systems be adequate to market it? Will new types of load require new facilities?

Here is a broad field for engineering research and study. Out of it should come much that is good.

Inspecticide

WHILE others in the electrical industry plan a brave new world of inventions and enterprises after the war, electrical inspectors are somewhat in the position of the overrun small nations. The war has done things to them that it will take a long time to rebuild, if ever. Meanwhile, inspectors are being told on every side what should be done to their Code to make it over to the heart's desire—somebody's else heart.

It is quite a different matter with the redesign of an automobile. If the engine should be in the back instead of the front, now that all production has stopped and new designs and tooling will have to be done, this is the time to make such a change. The Code, however, is a growth, not a machine. It has developed out of a multitude of necessities. Perhaps it overcompensates for some of its weaknesses, but it is a living organism that grows out of the soil of experience and in an environment of winds blowing from many directions. To say that it could be redesigned may express a technical possibility but it shows ignorance of ways of the human being from which it has sprung.

Inspectors meeting in the West late last month and early this month heard much advice in that respect. Academically they may agree with the arguments. But practically they may not do much to advance the causes so logically advised. As long as the Code was derived from experience, it will take experience to change it. Inspectors are not likely to commit inspecticide in so light a fashion, whether their Code is logical or not. They want to be shown first. People are funny.

IT'S only been a few years since businessmen felt that how they ran their business was nobody else's business. Nobody had to explain capitalism, nor defend private brands against grade labeling, nor to explain the economic benefits of advertising, because all of these things were taken for granted. During the nine long years that business spent in the doghouse, businessmen learned the bitter truth that while they were the best producers and salesmen in the world when it came to commodities, they were not so hot when it came to producing and selling ideas about what constitutes social progress. The business man must accept responsibility not only for providing continuous good living for ALL *Americans, but also for making sure that every voter understands where his good living really comes from . . . and that every voter understands what excessive government costs will do to good living. If these things are done, then socialistic planning can be modified to a point where it becomes part of industrial growth, instead of an obstacle in the path of industry. Yes, we have come to the period in our history when the fact that all good living depends upon the manufacture, distribution and sale of a constantly increasing volume of merchandise must be recognized by everybody.*—John E. Wiley, vice-president, Fuller & Smith & Ross, Inc.

PCEA Panorama

Edited by Mary Shoop

Electriquiz

Lighting has intrigued man from time immemorial, but only during the past two decades has he uncovered many of its secrets. The following information, taken from the book, *Playing with Lightning*, by Dr. K. B. McEachron and Kenneth G. Patrick, is supplied by O. A. Gustafson, district central station engineer, General Electric Co., San Francisco. For answers see page 108.

1. What probable range of voltage and current is present in natural lightning?
2. At the New York World's Fair 10,000,000 volts of man-made lightning flashed 30 ft. Would the energy in one flash operate a vacuum cleaner for approximately 20 minutes, 20 hours or 20 days?
3. How quick is a flash of lightning?
4. What is heat lightning?
5. Is it safe to remain in swimming during a lightning storm?
6. Does lightning strike more than once in the same place?
7. Where is the safest place in the home during a lightning storm?
8. Is it safe to play the piano during a storm?

Safety Ordinance

INTEREST in the PCEA-sponsored Unsafe Electrical Appliance Ordinance has extended throughout the eleven Western states. The legislation is now being given consideration for promotion by the Rocky Mountain Electrical League and the Electrical League of Utah, as well as local groups in the Northwest, Arizona and Nevada. Recent California cities adopting it are Alhambra, Bell, Beverly Hills, Covina, Monrovia, Montebello, Redlands, Redondo Beach, Santa Monica, Upland, La Mesa, Mill Valley, San Anselmo and Long Beach.

The League of California Cities has given the ordinance full support. Louis H. Burke, league legal counsel, worked with the PCEA code and ordinance committee on the final draft of the ordinance. The league then mailed a copy to every member city, accompanied by a letter recommending its adoption and calling attention to the fact that present conditions in the appliance field make this an opportune time to adopt legislation of this kind in order to have protection against the influx of substandard merchandise when appliance manufacturing is resumed after the war.

Committee Members

Appointments are announced for coming year

PCEA committee members for the present year are as follows:

Code and Ordinance Committee

Chairman, B. C. Hill, head of the department of electricity, City of Oakland; A. L. Stone, Stone Electric Mfg. Co., Los Angeles; D. E. Harris, General Electric Supply Co., San Francisco; J. O. Dillingham, General Electric Co., San Francisco; M. Kennedy Bliss, Board of Fire Underwriters of the Pacific, San Francisco; Arthur Veit, chief electrical inspector, Los Angeles County; H. L. Harper, Graybar Electric Co., Los Angeles; E. F. Watkins, Southern California Edison Co., Los Angeles; J. F. O'Donnell, Westinghouse Electric and Mfg. Co., San Francisco; E. A. Long, PG and E., San Francisco; H. H. Courtright, Valley Electrical Supply Co., Fresno; M. G. Sues, Leo J. Meyberg Co., Los Angeles; W. E. Cranston, Jr., Thermador Electrical Mfg. Co., Los Angeles; B. M. Tassie, G-E, San Francisco; A. H. Meyer, Leo J. Meyberg Co., San Francisco.

Red Seal Adequate Wiring Committee

Chairman, H. C. Rice, Edison Co., Los Angeles; A. I. Benedict, San Diego Gas and Electric Co.; J. O. Dillingham, G-E, San Francisco; J. A. Hill, PG and E, San Francisco; R. C. Wilkin, Phelps-Dodge Corp., Los Angeles.

Planning Committee (Incomplete)

Chairman, R. E. Fisher, PG and E, San Francisco; H. H. Courtright, Valley Electrical Supply Co., Fresno; R. C. McFadden, Edison Co., Los Angeles; R. M. Alvord, G-E, San Francisco; H. L. Harper, Graybar Electric Co., Los Angeles; G. C. Tenney, ELECTRICAL WEST.

Committee on Distribution Lines

Chairman, S. J. Lisberger, PG and E, San Francisco; A. C. Putnam, California Electric Power Co., Riverside; G. E. Jenner, San Diego Gas and Electric Co.; R. R. Cowles, PG and E, San Francisco; H. H. Minor, PG and E, Fresno; H. E. Jung, Edison Co., Los Angeles.

Guidance Committee of Business Development Section

Chairman, P. P. Pine, San Diego Gas and Electric Co.; vice-chairman, Milo Cain, Coast Counties Gas and Electric Co., Santa Cruz; C. A. Dahl, G-E Supply Co., San Francisco; J. H.

Who Am I?

I was born in Milwaukee, Wis., Oct. 22, 1882. My early education was received in grammar school and Navy apprenticeship. I enlisted in the Navy at the outbreak of the Spanish-American War in 1898, and served until October 1903. I studied special courses in electrical school and wireless telegraphy, and took a correspondence school course in electrical engineering. Who am I?

After a few months in the test department of the Southern California Edison Co., I joined the Los Angeles Gas and Electric Corp. in 1904, where I was in charge of meter testing and electric repair shop. From 1911 to 1912, I was associated with B. F. Kierulff & Co., Los Angeles, and Fort Wayne Electric Co. From 1912 to 1919, I was with General Electric Co., Los Angeles, in supply and apparatus sales. I left to engage in ranching at San Marcos and manage the Escondido Mutual Water Co. In 1921, I joined the San Diego Gas and Electric Co., where I have been inspector and assistant superintendent of the electric distribution department, sales engineer and engineer of lighting sales. I was appointed to my present position of commercial sales engineer in 1940. Who am I?

I have been a member of the Pacific Coast Electrical Assn. since its inception. I am a member of the San Diego Exchange Club, San Diego Electric Club, Elks, Spanish War Veterans and the Illuminating Engineering Society. I am married, have three daughters and six grandchildren. My grandchildren are my principal hobby but I am interested also in bees, chickens, victory gardening and golf. My name is: See page 108.

Gumz, PG and E, San Francisco; Victor Fink, Westinghouse Lamp Co., San Francisco; A. B. Murphy, Westinghouse Electric and Mfg. Co., San Francisco; A. B. Murphy, Westinghouse Electric and Mfg. Co., San Francisco; E. G. Stahl, PG and E, Fresno; Charles L. Moore, Chicago Flexible Shaft Co., Los Angeles; D. B. Wheelock, California Electric Power Co., Riverside; M. G. Sues, Leo J. Meyberg Co., Los Angeles; G. N. Hawley, Edison Co., Los Angeles.

Guidance Committee of Administrative Services Section

Chairman, F. C. McLaughlin, Edison Co., Los Angeles; vice-chairman, Harry A. Lee, PG and E, Stockton; Leon C. Heseman, California Electric Power Co., Riverside; H. H. Fogwell, Thermador, Los Angeles; R. N. Dreiman, Coast Counties Gas and Electric Co., Santa Cruz; E. A. Long, PG and E, San Francisco; C. W. Goodwin, Jr., G-E Supply Co., San Francisco; S. W. Scarfe, G-E, Los Angeles; P. B. Wilson, PG and E, Fresno; W. J. Lainson, San Diego Gas and Electric Co.; H. V. Busby, Edison Co., Los Angeles.

Guidance Committee of Operating Economics Section

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Industry Information Committee

Chairman, R. G. Kenyon, Edison Co., Los Angeles; I. W. Borda, The Okonite Co., San Francisco; A. D. Bragg, G-E, Los Angeles; H. H. Courtright, Valley Electrical Supply Co., Fresno; G. H. P. Dellmann, San Diego Gas and Electric Co.; H. Dewes, California Electric Power Co., Riverside; H. H. Fogwell, Thermador, Los Angeles; Charles Grunsky, Coast Counties Gas and Electric Co., Santa Cruz; R. G. Holabird, National Electrical Products Co., San Francisco; E. A. Long, PG and E, San Francisco; H. S. Schuler, Westinghouse, San Francisco; G. C. Tenney, ELECTRICAL WEST, San Francisco; M. W. Phillips, Edison Co., Visalia.

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Membership Committee (Incomplete)

Chairman, S. W. Scarfe, G-E, Los Angeles; vice-chairman, F. A. Mulvaney, Maydwell-Hartzell Co., San Francisco; J. W. Swank, Edison Co., Los Angeles; S. R. Robinson, San Diego Gas and Electric Co.; L. G. Peck, California Electric Power Co., Riverside; E. A. Long, PG and E, San Francisco.

Water Heater Standardization Committee

Chairman, H. C. Rice, Edison Co., Los Angeles; N. B. Hinson, Edison Co., Los Angeles; I. H. Lecklider, Edison Co., Los Angeles; R. C. Bragg, Vallejo Electric Light and Power Co.; G. E. Bishop, Coast Counties Gas and Electric Co., Santa Cruz; E. W. Meise, San Diego Gas and Electric Co.; H. G. Dillin, San Diego Gas and Electric Co.; B. W. Reynolds, PG and E, San Francisco; W. S. Fleming, California Electric Power Co., Riverside; A. L. Pierce, Sierra Pacific Power Co., Reno.

Budget and Finance Committee

Chairman, C. E. Houston, Edison Co., Los Angeles; S. W. Scarfe, G-E, Los Angeles; F. A. Mulvaney, Maydwell-Hartzell Co., San Francisco; N. R. Sutherland, PG and E, San Francisco; V. W. Hartley, PCEA.

Farm Electrification Handbook Revision

Editor, Lyle W. Smith, Edison Co., Visalia.

Industrial Power and Heating Handbook Revision

Editor, A. L. Laws, Edison Co., Vernon.

• BOARD OF MANAGERS meeting, consisting of new and old officers, was held for the San Francisco Bay Cities Section, Illuminating Engineering Society, at Lick Grill, San Francisco, Aug. 10. The program for the coming year and a schedule of the first meeting for installation of officers either Sept. 15 or 22 was discussed. W. P. Bear, Pacific Gas and Electric Co., retiring chairman, and Romaine Myers, consulting electrical engineer, Oakland, incoming chairman, called the meeting.

Withholding tax and how it affects the electrical contractor's business was discussed before the San Francisco Electrical Contractors Assn. at its Aug. 2 meeting by Glenn Graves, deputy collector from the office of the Collector of Internal Revenue. The board of directors had recommended to membership that, wherever possible, the weekly wage bracket (Table A-1) contained in Circular WT by the government to employers, be used.

Inspector Clinics

A suggestion that inspectors hold informational clinics met favorable response at the extra meeting of the Southern California Chapter, International Association of Electrical Inspectors, held at Los Angeles, July 21. Chairman W. J. Tretheway appointed the committee consisting of H. V. Dobson, chairman; H. C. Rice, A. I. Benedict, L. M. Trim and H. G. Ufer. It is to make a report at the Southwestern Section Code Breakfast Aug. 31 and again at the next Chapter meeting Nov. 17 in Glendale.

The suggestion for a clinic came from H. C. Rice, who addressed the afternoon session, describing the industrial future of southern California after the war. He also asked consideration by inspectors of a "wiring harness" for the range and water heater which can be removed by the customer and used at a new location. This was asked because about 50% of the company's range customers move each year.

C. K. Chapin, engineer, Bureau of Power & Light, talked on a pension plan for inspectors.

Other topics discussed at this extra meeting were the PCEA sales appliance ordinance, use of emergency installation type of wires concealed, the effect of permitting emergency wiring in areas adjacent to homes wired according to more rigid standards, power factor correction for fluorescent lighting, the availability of fuses and other inspectors' problems. The noon luncheon was given over to arrangements for the forthcoming annual meeting of the Southwestern Section in Los Angeles. Frank Short, general chairman, discussed the details, and wives of the members were present to arrange for the entertainment of women attending.

• JACK JACKSON, Jackson Sales Co., was elected president, San Francisco Pot & Kettle Club, for the new year beginning this fall. Other officers elected were Fred G. Wigmore, first vice-president; J. P. Loughman, second vice-president; E. M. Grinnell, corresponding secretary; George B. Koch, recording secretary; Albert Kessler, treasurer; and board of directors composed of retiring president Homer Q. Wilson, L. W. Sauer, Fred Wood, D. J. Bartelme, Walter Stone, and Bruno Kaufner. Advisory board members are Earl Robitscher, G. C. Gillan and George G. Foster.

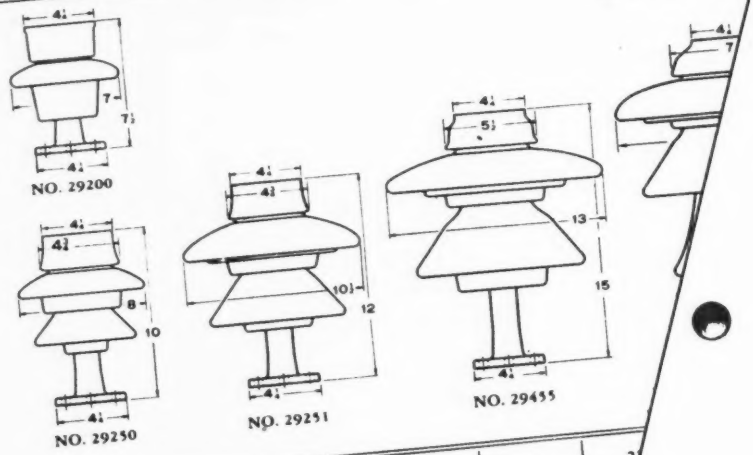
• ELECTION of officers for the Rocky Mountain Chapter, Illuminating Engineering Society will be held at the September meeting either the ninth or sixteenth in Denver. Last meeting was in July when T. J. Vieau, Crouse-Hinds Co., presented a film and gave a talk on *Airport Lighting*. H. V. Schockett and Carl Bischofberger gave *Highlights of Talks at Nela Park Lighting School.*

TWO "Must" PUBLICATIONS AND DESIGN ENGINEERS

LOCKE SWITCH AN

CAP AND PIN TYPE

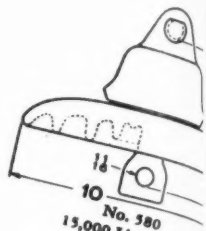
STANDARD ST



	7.5	15	2
*Voltage Rating, KV			
Catalog Number	29200	29250	29
Tapped Hole Cap			
*Flashover: KV (Note 3)			
60 Cycle Dry	60	85	
60 Cycle Wet	40	55	
Impulse — Positive	105	125	
Impulse — Negative	120	200	
*Withstand Voltage: KV			
60 Cycle Dry—1 Min.....(Note 4)	35	50	
60 Cycle Wet—10 Sec.....(Note 5)	30	45	
Impulse	95	110	
*Radio Influence Voltage			
Test Voltage to Ground—KV	5	10	
Maximum Microvolts at 1000 KC.—(Note 1)	50	50	
*Leakage Distance, Inches..(Note 2)	7½		
*Dry Arcing Distance, Inches..(Note 2)	5¼		
*Strengths			
Tension, pounds	5000		
Torsion, inch-pounds	6000		
Compression, pounds	10000		
‡Cantilever, pounds			
Upright, at Top of Cap	2000		
Underhung, at Base	1000		
Dimensions, Inches			
Bolt Circle	3		
Holes (Four) Tapped	⅝"-13 NC-2		
	¾" Deep		
Cap Screws	None		
Weight, pounds, each (Note 3)			
Net	14		
Packed	15		
Standard Package Quantity	6		

*These values are for the entire stack for voltage ratings 69 KV and above.
‡Cantilever strengths at points above cap or below base are given on pages 21 to 2

LOCKI



Clevis and Tong
Nos. 580 and

Insulator No. 1845—

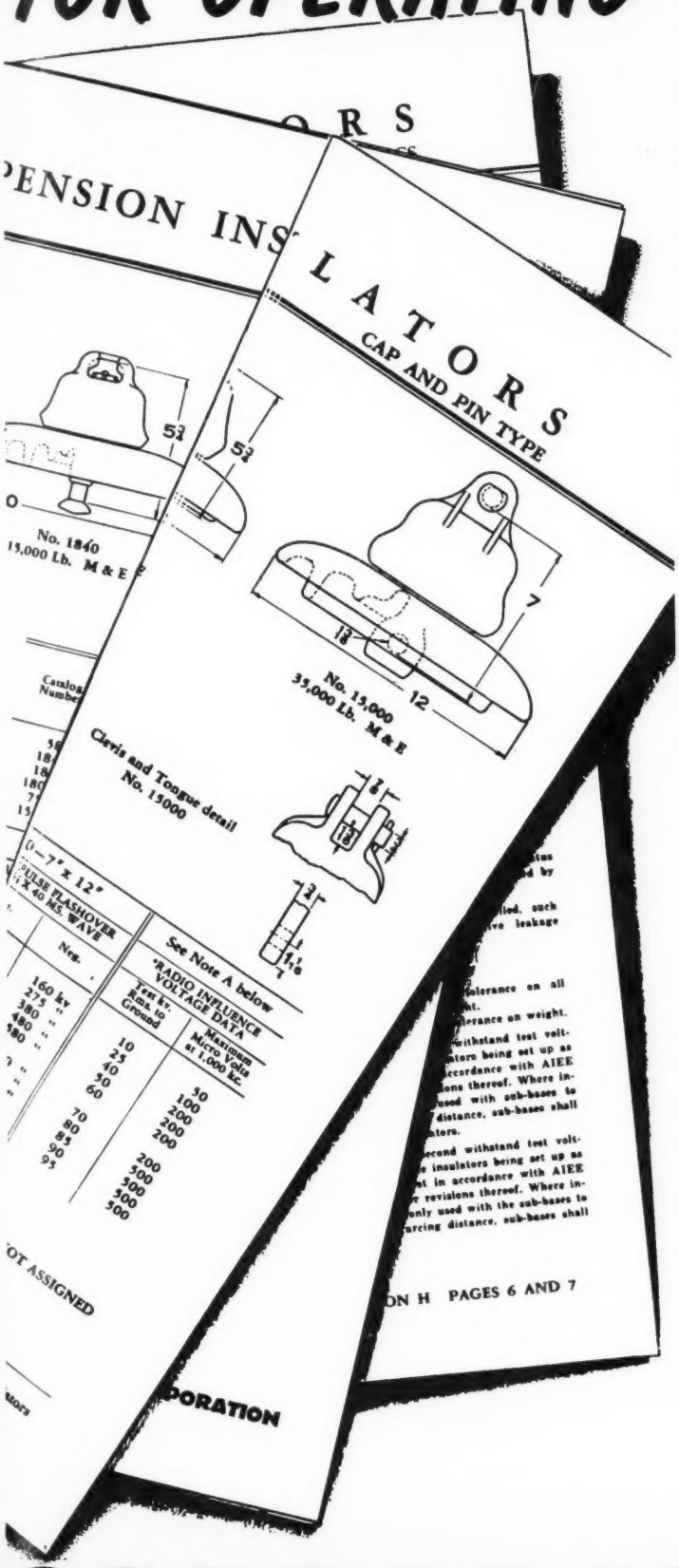
Number of Units	*SIXTY-CYCLE FLASHOVER	
	Dry	Wet
1		
2	80 kv	
3	145 "	50 kv
4	200 "	85 "
5	250 "	120 "
	300 "	155 "
6		190 "
7	345 "	
8	390 "	225 "
9	440 "	260 "
10	485 "	295 "
	530 "	330 "
11		365 "
12	575 "	
13	615 "	400 "
14	660 "	435 "
15	700 "	465 "
	745 "	500 "
16		530 "
17	785 "	
18	825 "	565 "
19	865 "	595 "
20	905 "	625 "
	945 "	660 "
		690 "

*SEE NOTES ON BACK PAGE OF THIS FOLDER

LOCKE INSULATOR

FIFTY PROGRESSIVE YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

FOR OPERATING



THESE TWO PUBLICATIONS list in convenient, get-at-able form full details and characteristics on all suspension and outdoor switch insulators which can be manufactured until the war has been brought to a victorious conclusion.

If you are concerned with the operation of existing lines or the design of new ones these two publications should be right at your elbow all the time. In keeping with the times they've been condensed to the barest essentials and yet the information is THE MOST COMPLETE LISTING OF PHYSICAL, MECHANICAL AND ELECTRICAL CHARACTERISTICS THAT HAS EVER BEEN COMPILED.

More than likely the insulators you are now using are included in this conservation line up. If not you will readily find in these few, easily read pages an equally satisfactory unit completely interchangeable with your present standards.

If special conditions arise, where inability to obtain insulators other than those now being manufactured would cause undue inconvenience or hardship, special approval may be granted by the War Production Board.

Of course, while the supply lasts many insulators not now manufactured are available. Any Locke district representative will be glad to tell you which these are and how many are in stock.

If you have not already received these data sheets write for them today. If you wish we will be glad to include a copy of Schedule 5 of Order L-154 to which this limitation conforms.

CORPORATION

BALTIMORE —3— MARYLAND

FIFTY PROGRESSIVE YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

Oregon IES Reports

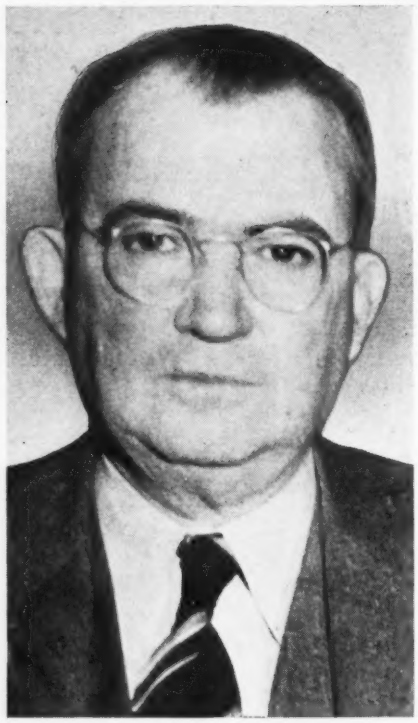
Completing its second year in a world at war, the Oregon Chapter of the Illuminating Engineering Society has summarized its activities for the fiscal year 1942-43 in a recent report by G. A. Charlston, secretary-treasurer, Eoff Electric Co., Portland. Its four meetings each have been directed toward topics pertinent to the war and war production.

At the October meeting, at which officers were installed, Proclamation 12 calling for dimout regulations was presented by C. T. Bakeman, assistant director of the Northwest Sector of OCD, Seattle. This was followed Dec. 8 when T. W. Fitch, Portland General Electric Co. and immediate past chairman of the chapter, dealt with industrial applications of the dimout. He prepared drawings illustrating shielding methods for reflectors and other means for compliance with the regulations.

Infrared applications were the subject of the March 9 meeting at which the speakers were C. P. Merklin, Norris, Beggs & Simpson, Portland, chairman of the chapter, and D. O. Bergey, of Northwestern Electric Co. Dave Robinson, Seattle, was one of the main speakers, telling of applications in the speeding up of paint drying in war industries by use of infrared lamps. Sidney Smith, of Ken R. Humpke Co., showed color slides portraying various applications. Harvey Endersby, of the B. P. John Co., furniture manufacturers of Portland, told of applications in the drying of finishes in that factory, more especially in the speeding of paint drying on Army truck bodies.

An all-college program was held May 11, when six men from Oregon State at Corvallis came to Portland under the direction of Dr. W. Weniger, head of the Physics Department. Dr. Weniger talked on the application of projection devices to replace blackboards in schoolrooms. Professor L. T. Wooster, dean of the School of Engineering, presented a talk on the work of the Army specialized training program at the college. Four senior students participated; J. C. Kyle spoke on *Optical Illusions*, and a survey of lighting in student study rooms was reported on by M. E. Coffey, L. M. Stinson and D. C. White.

● T. Ingledow, chief engineer, B. C. Electric Railway Co., has returned from attending the annual meeting of the American Institute of Electrical Engineers at Cleveland, and also from investigating conditions in the electric power industry in eastern Canada. Ingledow was named on an international committee of the AIEE to study with a similar committee from the EIC possibilities of the amalgamation of the two organizations in Canada.



J. A. Hale, vice-president, Utah Power & Light Co., was elected president of the Northwest Electric Light & Power Assn. at its recent annual meeting

Postwar Study

Study of postwar problems has been given to committees of the Electrical Service League of British Columbia by its council. Earl Dunsmuir, Dunsmuir Electric Co., has been appointed chairman of the committee to study licensing. H. F. B. Brooke, Northern Electric, is chairman of committee on credits; D. Robertson, Canadian General Electric, of one on salvage; M. Davies, Langley Electric, on codes and E. E. Walker, B. C. Electric Railway Co., on civilian supply. T. C. Clarke, Northern Electric Co., heads the committee on personnel rehabilitation.

The council also sent a resolution to the Canadian Electrical Assn., asking a release of materials for manufacture of table appliances for civilian needs and of wiring devices for residential construction. Copies of the resolution also went to governmental agencies.

Electronics at Work, a moving picture by Westinghouse Electric & Mfg. Co., was presented as the feature on the program of the Aug. 26 meeting of Electrical Maintenance Engineers' Assn. of Northern California, held at the PG and E Building, 447 Sutter St., San Francisco. Gano Baker, of Westinghouse, had charge of the program.

Conservation Urged

Electric utilities in the mountain region are poised to launch the fuel conservation program as outlined by the Office of War Utilities and the Inter-Agency Committee of the government. Coordinated by the Rocky Mountain Electrical League, all companies in the area were set up to hold employee meetings, issue advertising copy and radio broadcasts in the interests of the plan. An RMEL delegation, authorized by President Gaylord B. Buck, attended the recent meeting of the Council of Electric Operating Companies in Kansas City, Mo., to obtain first-hand information on the brownout program. This group was headed by George E. Lewis, RMEL manager, and C. C. Baker of Colorado Central Power Co., with H. G. Rankin, chairman of the league's lighting division, Guy W. Thomas, chairman of the power division; Hal Benson, Public Service Co. of Colorado's advertising and publicity department; Arthur Prager, Albuquerque Gas & Electric Co., and Luke Storey, manager of the Home Gas & Electric Co., Greeley, Colo.

In anticipation of the start of the brownout schedule, the league's Managers' Conference Sept. 13 will be dedicated to this voluntary conservation effort. Tom P. Walker, president of the Council of Electric Operating Companies, Washington, D. C., will be the featured speaker. He will be prepared to answer some of the many perplexing questions that enter into this nation-wide undertaking. RMEL, to completely round out its preparations, has made contact with other industries to be embraced by the program, in order that all phases of conservation shall be properly integrated and coordinated.

Vancouver Elects

W. D. Robertson, British Columbia manager of Canadian General Electric, was recently elected president of the Vancouver Electric Club for the coming year. F. J. Bartholomew, Electric Power Equipment, was named vice-president and F. H. Hedley, Canadian Westinghouse, secretary. J. Todd of the B. C. Electric Railway Co. is treasurer. Directors of the club are E. E. Ackland, Canadian General Electric; M. F. Crosby, Canadian Westinghouse; A. Darlington, Northern Electric; M. Davies; S. J. Fawcus, B. C. Electric; R. A. Benson, Canadian Wire & Cable Co.; J. C. Munro, B. C. Electric; E. E. Walker, B. C. Electric.

You can have THE RIGHT LINK at the RIGHT PLACE at the RIGHT TIME

KEARNEY'S *Precision Built* FUSE LINKS

THERE are many reasons why so many operating men are using Kearney Fuse Links. Whether they specify the new Type 200, the Quik-Action Fitall or the Trip-O-Link Fuse, they find they get the dependability expected of a precision built link. With such factors as adaptability, strength, temperature, durability, accuracy and speed carefully considered in their design, these links assure efficient switch performance. And now ease of handling, storing and dispensing have been added to other features to give even greater value, at no extra cost.

features of the NO. 12165-B FUSE LINK DISPENSER

See from the ground whether you have links on the pole ready to handle an emergency. Pul Tabs of Kearney Fuse-Paks tell you.

Keep your fuse link coordination schedules accurate with a supply of proper amperage sizes right on the pole.

You might have the right link on your storeroom shelf, but why not have it at the point of use—in a pole-mounting fuse container?

Using KEARNEY FUSE LINK DISPENSERS *COMBINED WITH NEW* PUL-TAB FUSE-PAK

At the right, the new Kearney Pul-Tab Fuse-Pak. Contains 5 fuse links, each packed in individual weather-resistant bags, each bag having a "pul-tab" clearly marked with amperage rating of link.

Above, the new Kearney Fuse Link carton for easier storeroom handling contains 5 Pul-Tab Fuse-Paks, 5 links to a Pak, 25 links to a carton. Each carton carries information on primary fuse sizes for distribution transformers.

NOW—minimize the risk of upsetting your fuse link coordination schedules—the hazards of over-fusing—unnecessary delays in restoring service. Assure these advantages by installing, right on the poles, at important switching locations, a Kearney Fuse Link Dispenser which is specially designed to hold a Pul-Tab Fuse-Pak containing five proper links.

After all, for convenience and emergencies, you want the right link at the right time, at the point of use—and reserve links, of course, on your storeroom shelves.

all Kearney Links packed in Pul-Tab Fuse-Paks

Whether or not you use the No. 12165-B Fuse Link Pole Dispensing Boxes which, incidentally, cost only 49c each, take advantage of the handy Pul-Tab Fuse-Paks and handy cartons of 25 links, the standard package for all Kearney Links, at no extra cost.

EXCLUSIVE SALES REPRESENTATIVES

OUR NAME SPELLS QUALITY

MAYDWELL & HARTZELL

LOS ANGELES • SAN FRANCISCO • PORTLAND • INCORPORATED SEATTLE • PHOENIX • RENO • TACOMA • SPOKANE

ON THE BEAM

"DON'T talk about radar" is the admonition of the Office of Censorship. The radio industry went overboard when the bars were let down recently. It talked too much, claimed too much and speculated too much. Now nothing can be said. Radar is still a secret weapon within the full meaning of the word. National security dictates that it be kept just that.

★

Stove rationing finally is to go into effect, but still no provision is made for replacement of electric ranges that are beyond repair, nor of electric water heaters either, although gas water heaters are to be made for replacement of burnouts. If it takes loud squeaks to get grease from the government agencies, then a high pitched electric squeal should be turned on immediately.

★

Looming up as a postwar promotional entity with a real future is the newly organized Indoor Climate Institute. It's made up of people in the heating business — furnace makers, stoker builders, thermostat manufacturers, valve fabricators and others. The initial list of sponsors says nothing about air conditioning people. Unless this branch of the electrical industry is included, the term "Indoor Climate" will be meaningless.

★

Nobody likes a stool pigeon, but a recording demand meter at Marinship earned that appellation when it tattled on the entire yard personnel by writing an irrefutable record of power use during the 24 hours of daily operation. The meter squealed that power consumption, and therefore welding and other forms of work, began to quit at 11:30 p.m., a full half hour before the end of the swing shift, hit bottom before the whistle blew, and took about half an hour to rise while the graveyard shift got into production stride. Similar drops and recoveries were recorded for the 8 a.m. and 4:30 p.m. shifts. Lunch periods were as bad. Now employees have been offered War Bond prizes for suggestions as to how conditions might be corrected.

★

Aircraft need many electric motors. The bigger they are the more motors they need—the more horsepower for the least weight. This has put the slide rule design engineers to work on intensive research. What is developed may influence motors for industrial purposes in the future. New metals will play an important role in this change.

★

Any advertising agency that spent as much money as the industry has wasted in the promotion of adequate wiring in the home, would have been booted out in a hurry. No one has come up with the right answer to this question. Maybe some "Kaiser can-do" is required to crack it. It is a challenging postwar opportunity.

★

Superlatives are commonplace to the Far West. Here is another one: the largest magnesium producing plant in the world is Basic Magnesium in Nevada. It achieved that distinction early in August when all but 12 of the furnaces went on the line. Incidentally it simultaneously became one of the largest single electrical customers in the world at the same time.

★

Postwar planning proposal for the enterprising municipal system in Eugene, Ore., is that a 10% surcharge be added to all light and power bills now to raise funds for placing the whole distribution system underground once the war is over. The scheme has its pros and cons; it is something that only could be applied to a publicly-owned system whose rates are unregulated.

★

Utilities are beginning to worry about power factor when fluorescent lighting invades the home—and rightly so from their operating standpoint. Either they must get concerted action through the manufacturers' organizations to have all equipment self-corrected, or they will have to assume the responsibility themselves. The "foam on the beer" represented by a huge low-power-factor load would require a lot of "skimmers" in the form of static condensers if the electrical "pipe lines" are to be kept open for capacity loads.

★

A maintenance scale of wages for electricians may be tried out in southern California as a means of permitting contractors, whose wartime new construction work is almost over, to go after electrical maintenance among war industries. Paying a full construction scale for electricians, they could not compete with the resident maintenance electrician's scale which the unions have always permitted. Union and contractors have been working on this dilemma in earnest. Chicago has had such scales. This will be the first on the Coast if it goes through.

★

There will be *enough* lamp globes for civilians this winter, the lamp companies say, providing civilian demands are reasonable. During the off season of summer they have gone on making lamps to the limit of their quotas in order to build up a stockpile for the winter months. There will be no sales effort put back of lamp distribution, of course, but of the standard types of bulbs there will be enough to go around.

★

Good lighting men may be scarcer than hen's teeth after the war. Wouldn't it be a good idea for sales managers to drop a friendly line to lighting men now in the armed forces? A recent OWI survey showed that the service man's biggest worry was a job after he came home. Such a note would let him know that the door would be open for him.

★

A postwar annual lighting equipment exhibition and congress has been proposed by the industrial and commercial lighting equipment section of NEMA. The proposal is founded on the belief that there is a definite need for such an exhibition in order to provide opportunity for manufacturers, wholesalers, contractors, public utilities, architects and others to meet and discuss constructive developments and plans for this most important electrical field.

★

An impartial observer would say that the industry is doing too much worrying about new postwar light sources and not enough planning about postwar lighting sales programs. There is one certainty: the manufacturers will provide good equipment to be sold. The ability to sell it is something else again.

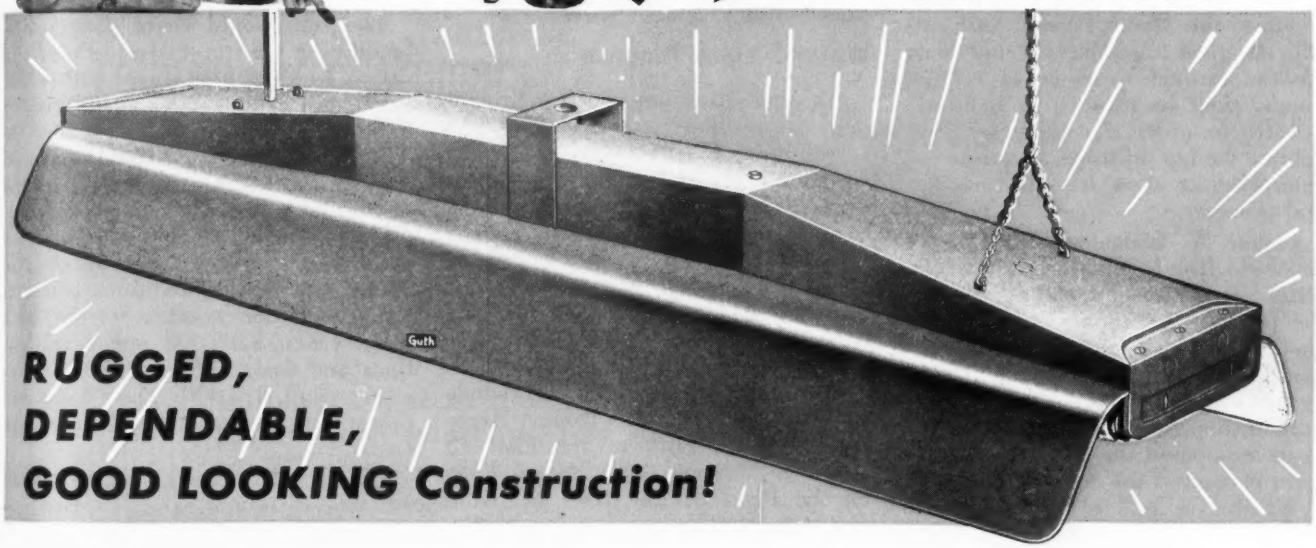
★

Police had to be called to handle crowds of shipyard workers at Swan Island so eager were they to get copies of a picture of one of their tankers depicted in a South Seas port. The picture was a copy of the beautiful artwork from a Portland General Electric Co. advertisement. It packed a powerful "pride-in-your-job" story that appealed to the workers. Giving copies away was a fruitful public relations gesture by PGE.

It's DIE-FORMED from a *Single Sheet of Steel*

Guth SUPER ILLUMINATOR

U. S. T. M. REG. & PATS. PENDING



RUGGED, DEPENDABLE, GOOD LOOKING Construction!

HERE'S an engineering achievement—a Fluorescent Fixture that conforms to W. P. B. metal limitations—yet its Accessory Housing is completely formed in a single piece so that all operating parts are "under cover" for complete protection! It's unique construction produces an amazingly rigid, substantial unit—with added strength—yet the cost is no higher than that of ordinary Fixtures.

Masonite "REFLECTOR BOARD" Reflectors, finished "300° White" (88% R. F.), are easily removed and reinstalled with a quarter-turn of the "Flexible Trigger".

Fixture is easily installed—hangs anywhere—anyway! Eggcrate Louvres for extra lamp-shielding available if desired. "Bump-Proof" end-plates give added lampholder protection. Starters easily accessible even when fixture is mounted directly to ceiling. Maintenance is fast—easy. Suitable for single or continuous installation. Available in sizes for 2 or 3 40-watt lamps—or 2 100-watt lamps.

Here's Something Completely New in Fluorescent

...the GUTH QUICK-LITER

Here's the last word in Fluorescent development! GUTH QUICK-LITERS are identical to SUPER-ILLUMINATORS except that they are built with special ballasts; perfected for speedy, efficient action. Quick, positive starting... **without the use of Starter Switches! Lower operating costs!** Tested in use for over a year and approved by users everywhere!

Write or wire collect. A Representative will call with actual samples to demonstrate superiority of these GUTH Fluorescent Fixtures.

★ ★ ★ ★ ★ ★ ★ ★

Leaders in Lighting Since 1902 **Guth**

★ ★ ★ ★ ★ ★ ★ ★

THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.

NEWS of the industry

COLORADO UTILITY COMES UNDER "DEATH SENTENCE"

Public Service Co. of Colorado received official confirmation Aug. 18 that the "death sentence" on holding companies, incorporated in the Wheeler-Rayburn bill of 1935, will be enforced by the Securities and Exchange Commission, causing Cities Service Co. to divest itself of the Colorado electric and gas utility.

The order may cause Colorado's legislature to meet in extraordinary session for the purpose of determining whether the State Power Authority Bill, designed to purchase Public Service Co. through issuance of revenue bonds, shall be passed (or definitely killed), in order that Colorado may operate the big utility as a state-owned enterprise, or allow it to become federal property.

Claude W. Blake, secretary of the Colorado House of Representatives interim committee—appointed to study the power bill and act if conditions should warrant—expressed the opinion that his committee will meet shortly. Beyond that, he refused to commit himself. Representative Blake is known to have opposed the power bill in the form it reached the Assembly floor.

Whether a poll of representatives and state senators will disclose such strong opposition that further consideration of the proposed measure will be useless remained in doubt. However, an influential group of legislators favoring the power authority was reported busy immediately after announcement of SEC's action.

Although legal steps to delay seizure of Public Service Co. can be taken, company officials expressed doubt that recourse to courts will be made, since SEC's power has already been upheld by circuit courts, and is pending before the U. S. Supreme Court.

Well-authenticated reports have it that Cities Service Co. has, for months, been dickering with private capital for the purchase of Public Service Co., whose subsidiaries include Cheyenne (Wyo) Fuel and Power Co.; Colorado-Wyoming Gas Co., and other smaller firms.

Federal Light and Traction Co., a Cities Service Power and Light holding company subsidiary, is also affected by the SEC order. Albuquerque Gas & Electric Co., Trinidad Electric Transmission Railway and Gas Co., and the Las Vegas (New Mexico) Light & Power Co. make up a single, integrated system retainable by Federal Light & Traction. The SEC order said that Federal may keep properties of the Stonewall Electric Co. and that portion of the New Mexico Power Co. essential to provide generating facilities.

Severance of Public Service Company from its 15% interest in the Colorado Interstate Gas Co. is also ordered in the SEC mandate. This enterprise supplies natural gas from the Amarillo, Texas, fields to Denver, northern Colorado and points in Wyoming.

Bonneville Proposes New Water Storage Program

An alternative proposal for providing storage capacity on the headwaters of the Columbia River for use in the Grand Coulee and Bonneville power plants has been advanced by the Bonneville Power Administration. The plan has been offered as a substitute for original proposals which met with a storm of protest in Montana and Idaho where the dams would have been located.

The new program would include three storage dams: (1) Hungry Horse on the South Fork of the Flathead River in Montana; (2) Albeni Falls on the Pend Oreille River in Idaho and (3) the Kootenai Lake on the Idaho-Canadian border. Together they would supply the 6,000,000 acre-ft. of water required to firm up the generating facilities at the two power plants.

Hungry Horse dam would be 450 ft. high and would provide 1,500,000 acre-ft. of storage. It would include a 142,000-kw. power development. Albeni Falls would store 2,000,000 acre-ft. Kootenai Lake could store up to 3,000,000 acre-ft. but would require joint approval of the U. S. and Canada.

● NATURE is providing hot weather air conditioning to the government town of Coulee Dam while Mason City, the contractors' community across the Columbia River, swelters. A 10 to 15° temperature differential exists when the winds are in the right direction. Some 2,000,000 gal. of 61° water hourly runs over the 330-ft. spillway of the dam setting up a rising cool spray which the wind blows over the town.

● PORTLAND GENERAL ELECTRIC CO. and Mountain States Power Co. have agreed to wheel power for the Bonneville Power Administration to a new U. S. naval air station on the West Coast.

$4,900,000 PRICE SET IN PURCHASE NEGOTIATIONS

Preliminary negotiations covering the sale of the Imperial Valley properties of the California Electric Power Co. to the Imperial Irrigation District have been virtually completed. Purchase price agreed upon is $4,900,000. Final steps include approval of the sale by the California State Railroad Commission and the state corporation commission and ratification by district voters at an election to be held some time in September.

The sale would cover distribution facilities in the Imperial and Coachella valleys which will be served with water from the All-American Canal. District financing would be through a $6,000,000 revenue bond issue. Items covered by the bond issue in addition to the direct purchase would include preliminary expenses $70,000; consolidation and improvement of the two electric systems, $750,000; additions and betterments to the systems for the next three years, $205,000 and investigations and designs for the Pilot Knob power plant, $75,000. The Pilot Knob power site is on the All-American Canal.

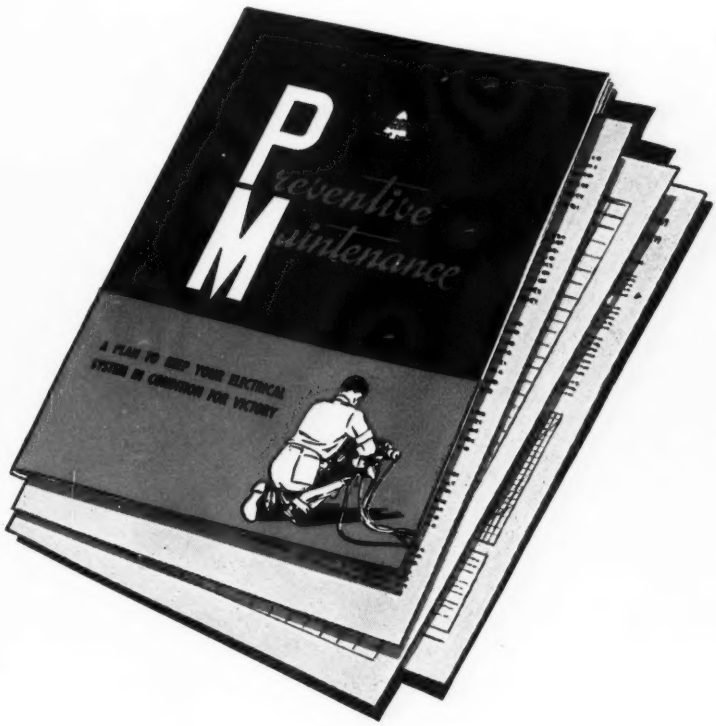
Considerable rearrangement would be involved in integrating the two systems. This would include tying together the power company's 88-kv. transmission lines now feeding the area from the north and the district's 33-kv. system which feeds from the south and east. Also much of the company's 16.5-kv. system would be cut over to 33 kv. The company's 2,300-volt system would be cut over to 4 kv. in the towns served and to 12 kv. in the rural areas. Both of these latter voltages are standard with the district.

PG and E Asks Approval On Purchase Applications

Pacific Gas and Electric Co. has asked approval of the California State Railroad Commission for the purchase of the facilities of the Northern Light & Power Co. of Garberville and the system owned by George L. East at Weott, both in California. The application focuses attention on the attempts of the company and the Redwood Electric Cooperative to secure the East properties. The Redwood Electric REA project had secured a loan of $200,000 for the purchase. Both the company and the REA have gone into court with their claims.

OVER 50 UTILITIES

using PM plan to help power customers avoid Electrical Breakdowns



Introduced a short time ago, Anaconda's Preventive Maintenance Plan is being widely used by utilities to help customers keep electrical systems operating *efficiently*—despite shortages in essential wiring equipment.

Already some 50 utilities are actively engaged in this program. With it, they are helping their industrial power customers maintain continuous wartime production by preventing electrical breakdowns.

WHAT THE PLAN IS

The PM plan is a simple but comprehensive way to safeguard war production by preventing electrical breakdowns *before they develop.*

HOW IT WORKS

The plan provides a practical means of making periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to *prevent* breakdowns.

HOW UTILITIES BENEFIT

The PM plan helps utilities maintain close customer contact despite a lack of "something to sell." Offers basis for service campaign that definitely appeals to customers. Puts the utility in a leadership role for furthering war production throughout the area it serves.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details.

43237

"Tomorrow may be too late . . . do it today!"

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

ANACONDA

Anaconda Wire & Cable Company
25 Broadway, New York City 4

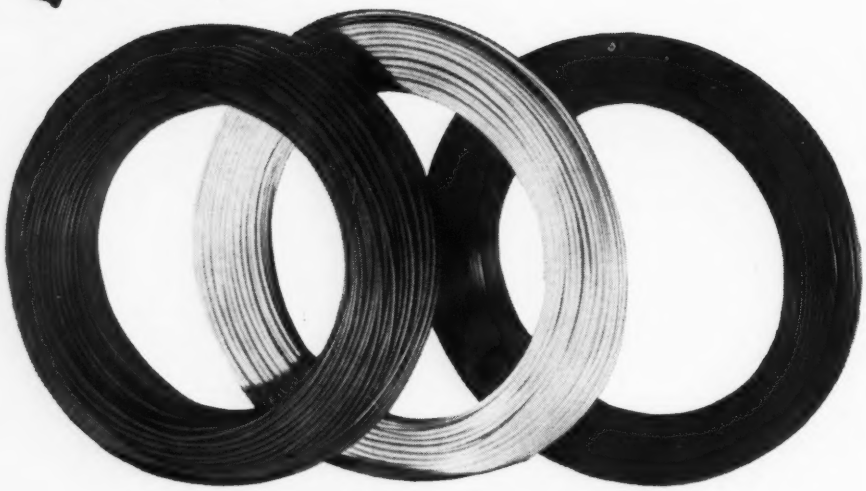
Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

Individual .....

Company .....

Address ..... City .....

FOR ALL War Wiring



FLAMENOL* BUILDING WIRE

TYPE SN

Use this small-diameter thermo-plastic building wire for all war-purpose wiring jobs. It is available in sizes 14 and larger. Flamenol Building Wire is ideal for maintenance wiring . . . for re-wiring . . . for new wiring. Its small diameter, comparative light weight and smooth finish make it easy to handle. Its insulation is superaging, high in dielectric and mechanical strength, flame retarding and resistant to oils, moisture, acids, etc.

You can obtain this dependable wire now because the available supply of resins has improved. They are permitted for electrical conductor insulation wherever copper is allocated.

For further information on Flamenol Building Wire, see the nearest G-E Merchandise Distributor or write to Section W931-18, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

*Reg. U.S. Pat. Off.

GENERAL ELECTRIC

FPC ORDERS UTILITY TO DISPOSE OF $27,000,000

Outcome of the original cost study of the Utah Power & Light Co. is a Federal Power Commission order directing the company to dispose of over $27,000,000 resulting from asserted write-ups and other improper charges and to submit to the FPC within six months a revised classification and original cost studies of the remaining $56,500,000 in other accounts. The order directs that $26,434,849 be charged to earned surplus, or if the company elects, it may eliminate all or part of the amount by a charge to capital surplus created through a write-down of its common stock.

The FPC charges that the inflation recorded in the company's books arose out of eleven transfers of properties from Electric Bond & Share Co., Utah Power Co., Utah Securities Corp. and Electric Power & Light Corp. The order specifically lists the following:

"(1) Transfer by Utah Securities Corp. in 1912 of the assets of the Telluride Power Co., which light company recorded on its books at $21,168,673.57. The cash cost of these securities to Bond & Share (which had acquired the bulk of Telluride's securities and transferred them to Utah Securities Corp.) and to Securities Corp., was $6,268,503.19, the opinion says. Thus, the write-up in this case was more than $14,900,000.

"(2) In 1913, Utah Securities Corp. transferred to light company, among other things, the electric properties of Utah-Idaho Sugar Co. and three other corporations. Light company recorded these properties at $7,549,452.78, although they had been previously acquired by Bond & Share and Securities Corp. at a cash cost of $2,128,477.61, resulting in a write-up of more than $5,400,000.

"(3) Light company in 1913 surrendered its investments in Utah Power Co., a wholly-owned subsidiary company, in return for the net assets of Utah Power Co. The latter properties had been transferred to Utah Power Co. by Securities Corp. and Bond & Share, which in turn had acquired them at an actual cost of $3,251,328.95. The $8,937,004.46 at which these properties were recorded on the books of Light company, was thus, the opinion points out, $5,644,288.73 in excess of their *bona fide* cost."

The company had until Sept. 1 to appeal the order. Following the FPC order, there was considerable local speculation as to what effect this might have upon the rate proceedings now before the Utah Public Service Commission with early decision expected.

WAR BONDS MAKE UNCLE SAM MORE POWER-*full*

ARMY E NAVY

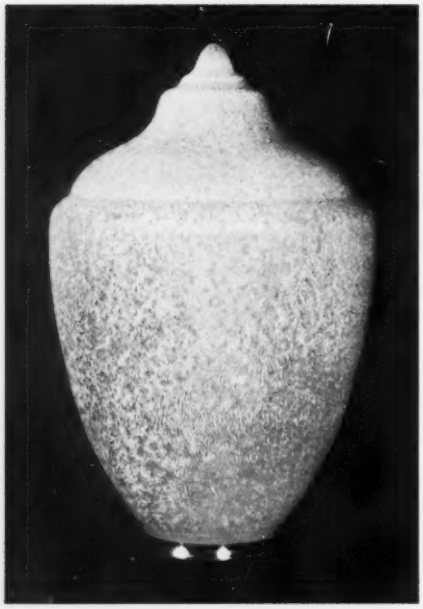
"On Measurement is founded the whole progress of man.."

In counting, the Romans used units of five based on the fingers of the hand. They would mark I "one", II "two", III "three", IIII "four", and to show a "tally", the fifth mark was diagonal, forming a V. So V meant five; X meant double V, or ten. Counting sheep was the test of accuracy. If the counter bent his head to mark a "tally", many quick little sheep could dart past; if he attempted to memorize the "tallies", he became so drowsy that whole units were often forgotten. Yet, that was the conception of accurate measurement. Compare it with today's high standard of measurement of electricity set and met by the electric utilities and the manufacturers of watthour meters.

NO OTHER COMMODITY IS MEASURED SO *Accurately* AS ELECTRIC POWER

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

STREET LIGHTING
Replacement Units
Immediate Shipments



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DEBATE FOLLOWS ORDER TO BUILD SHASTA LINE

Congressman Albert E. Carter of California and Secretary of the Interior Ickes have had a heated exchange of correspondence on the question of the unauthorized construction of the Shasta-Oroville transmission line by the USBR. When Carter threatened "a rude awakening" for the "Secretary of the Interior and Bashore and others in the Interior Department" Ickes came back with the assertion that the Congressman was "making a virtual gift to a privately owned utility company of a Federal investment costing the taxpayers many millions of dollars."

In a telegram to Assistant Secretary Michael Straus Congressman Carter said that "the action of the Interior Department in this matter is the first betrayal of a committee's expressed recommendations by any department of which I am aware. Bashore states the House Committee's action and then proceeds to do just the opposite. In other words, Bureaucrat Bashore overrules the legislative branch. If the Secretary of the Interior and Bashore and others in the Interior Department are under the impression that they can disregard the legislative intent and succeed please assure them they are due for a rude awakening."

Secretary Ickes in his letter declared that "the Shasta-Oroville line must be built by the government or by the Pacific Gas and Electric Co. Construction must be completed by March of 1944, when Shasta power is scheduled to be available for war industries and other loads in the area. If the line were constructed by the Pacific Gas and Electric Co., that company would enhance its chances of being the only purchaser of Shasta power. In effect, it would then have taken a long step in carrying out the plan, at which it has worked assiduously for many years, of capturing an investment of millions of dollars in the dam and power plant which has been made by the people of the United States. If Congress wishes to direct me to play Santa Claus with taxpayers' money to the Pacific Gas and Electric Co., I shall, of course, do so; but Congress must clearly direct me. I will not voluntarily give any privately owned company the only key to a public structure worth millions of dollars which was built with taxpayers' money for the benefit of all of the people of California and the United States. So long as I have the authority to keep that key in the possession of the United States government to be used for the benefit of the people whose money built this dam and power plant, I shall do so."

The Secretary also pointed out that he had obtained and had sent to all members of the House appropriations committee an option from the Interior Department solicitor giving him legal grounds for proceeding with construction of the line.

$207,531 Is Low Bid for Construction of Line

Seventeen bids ranging from a low figure of $207,531 submitted by the R. H. Wattson Co. of North Hollywood, to a high of $728,976 were received for construction of the Shasta-Oroville transmission line by the U. S. Bureau of Reclamation.

The Shasta-Oroville line is a feature of the permanent transmission network of the multiple-purpose Central Valley Project. The initial electric energy generated at Shasta Dam, which is incidental to the navigation, flood control, and irrigation features of the project, will be carried over the new line to Oroville where, as a wartime measure, it will be fed into the transmission system of the Pacific Gas and Electric Co. A wartime contract between the bureau and the company for the sale and purchase of power is under negotiation.

The transmission line will be a 230,000-volt, wood-pole, H-frame type line approximately 100 miles long. The conductor is to be of steel-reinforced aluminum for which the War Production Board made an allocation of 1,207,800 lb. of aluminum in July. After an award is made the contractor will be required to commence work within 15 calendar days and to complete it within 110 days after receipt of official notice to proceed.

The bureau ordered the conductor in July, and all other transmission line materials to become a permanent part of the completed work have been purchased.

Fourth Unit In Operation At Grand Coulee Dam

Grand Coulee's fourth 105,000-kw. unit went into operation early in August, bringing the installed capacity of the plant up to more than 600,000 kw. Three additional units of this size are to be installed in the next year and a half, bringing the total capacity in 1945 up to 950,000 kw., second only to Boulder Dam.

When present power installations at the Grand Coulee and Bonneville stations are completed the total installed capacity of the two stations will be 1,424,800 kw.

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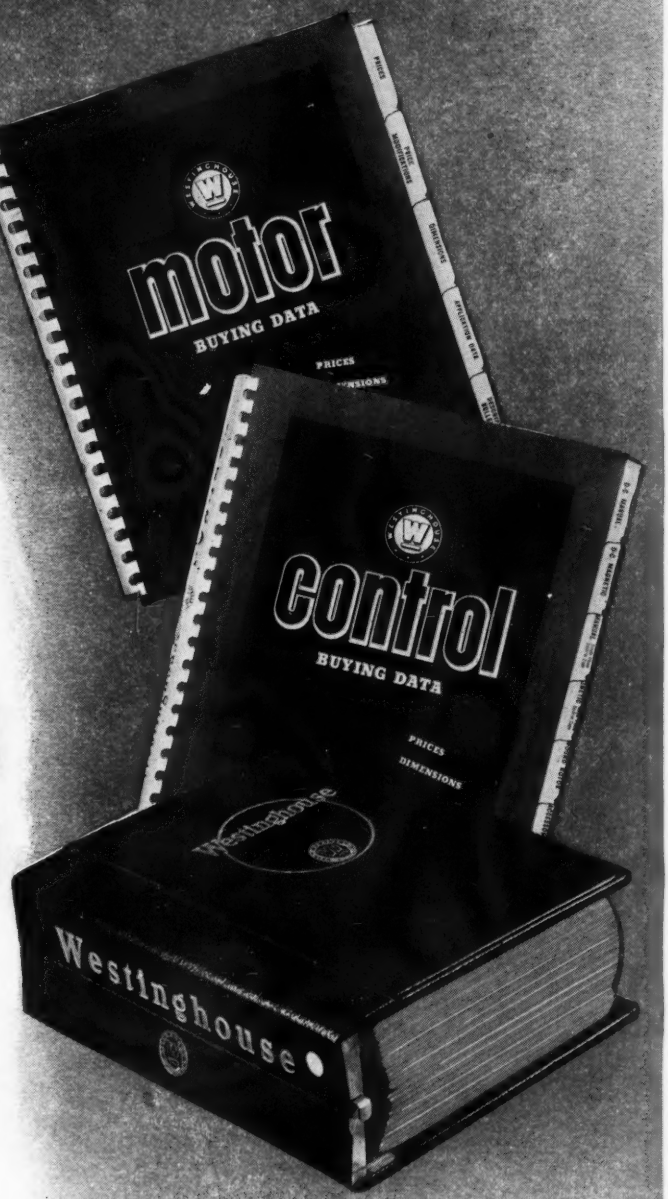

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Complete equipment for making hot tap connections should include the Grip-All clamp stick—available with either set of jaws as shown above. The hand grip will open and close the jaws to contact the clamp, close on the eye screw and pull the clamp into the head to make a rigid unit for applying the clamp to the conductor. Write for detailed information.

A·B·CHANCE CO. CENTRALIA MISSOURI

NAVY CITES UTILITY FOR OUTSTANDING SERVICE

A citation for "meritorious wartime service" signed by Rear Admiral D. W. Bagley, USN, Commandant of the Eleventh Naval District, was awarded last month to San Diego Gas & Electric Co. Reportedly the first award of its kind on the Pacific Coast, a certificate bearing the citation was presented to Hance H. Cleland, company president, by Capt. A. K. Fogg (CEC) USN, at ceremonies attended by more than 500 employees of the utility.

The citation was in recognition of the power company's contribution to naval expansion in the area, which has involved installation of gas and electric facilities to many times the usual requirements.

Prefacing his remarks with the observation that the Navy has never been lavish in its praise, Capt. Fogg declared that the company's outstanding record had earned the Navy's highest compliment—"Well done." He called attention to the handicaps which the company had "cheerfully over-ridden in its highly successful efforts to operate at an absolute maximum of efficiency for the greatest possible benefit to our armed forces and our production front here at home." He praised labor and management alike for singleness of purpose under emergency conditions, and paid tribute to the company's assistance in planning to provide the best results while using the smallest possible amount of critical material.

● GENERATORS of the Bonneville-Grand Coulee power system carried a record load of 1,033,000 kw. on Aug. 17, exceeding a million kilowatts for the second successive day. The load exceeded the 992,400 kw. installed capacity of the machines by more than 40,000 kw. Proportionately greater overloads have been carried by individual machines, however, with the present record at 18% over rated capacity.

At present there are eight units at Bonneville with two additional machines scheduled for power production in January 1944. At Grand Coulee four 105,000-kw. units and two 75,000-kw. Shasta generators are operating with the fifth and sixth main units scheduled for completion by February 1944.

Oregon Town Starts Job Stockpile

Eugene, Ore., isn't waiting for Santa Claus to arrive from Washington and is going ahead with a $10,000,000 stockpile of jobs for postwar days. New schools is the largest item. Schools, sewers and clearing of business blocks for off-street parking to protect property values will be financed by funds built up by maintaining present special tax levies instead of reducing taxes as former public projects are paid off.

Eighty miles of underground would be installed by the municipal power system over a period of 20 years at a cost of $2,778,000. Financing would be by a 10% surcharge on each light and power bill which would raise $70,000 annually. A fund thus built up would be available to start the work as soon as the war is over. Voters will be asked to approve each major item in the $10,000,000 program. A part of the school program has already been approved at a special election by a vote of 10 to 1.

Hance H. Cleland, president San Diego Gas & Electric Co. receives citation from Capt. A. K. Fogg, U. S. Navy

FUSE AND CONTACTOR SWITCH-GEAR FOR HIGH VOLTAGE MOTORS

Short Circuit Protection at Lower Cost—With Saving in Critical Metals

S&C Power Fuses for short-circuit protection are now being used in combination with oil-immersed contactor,—in one assembly,—on high voltage induction and synchronous motor installations.

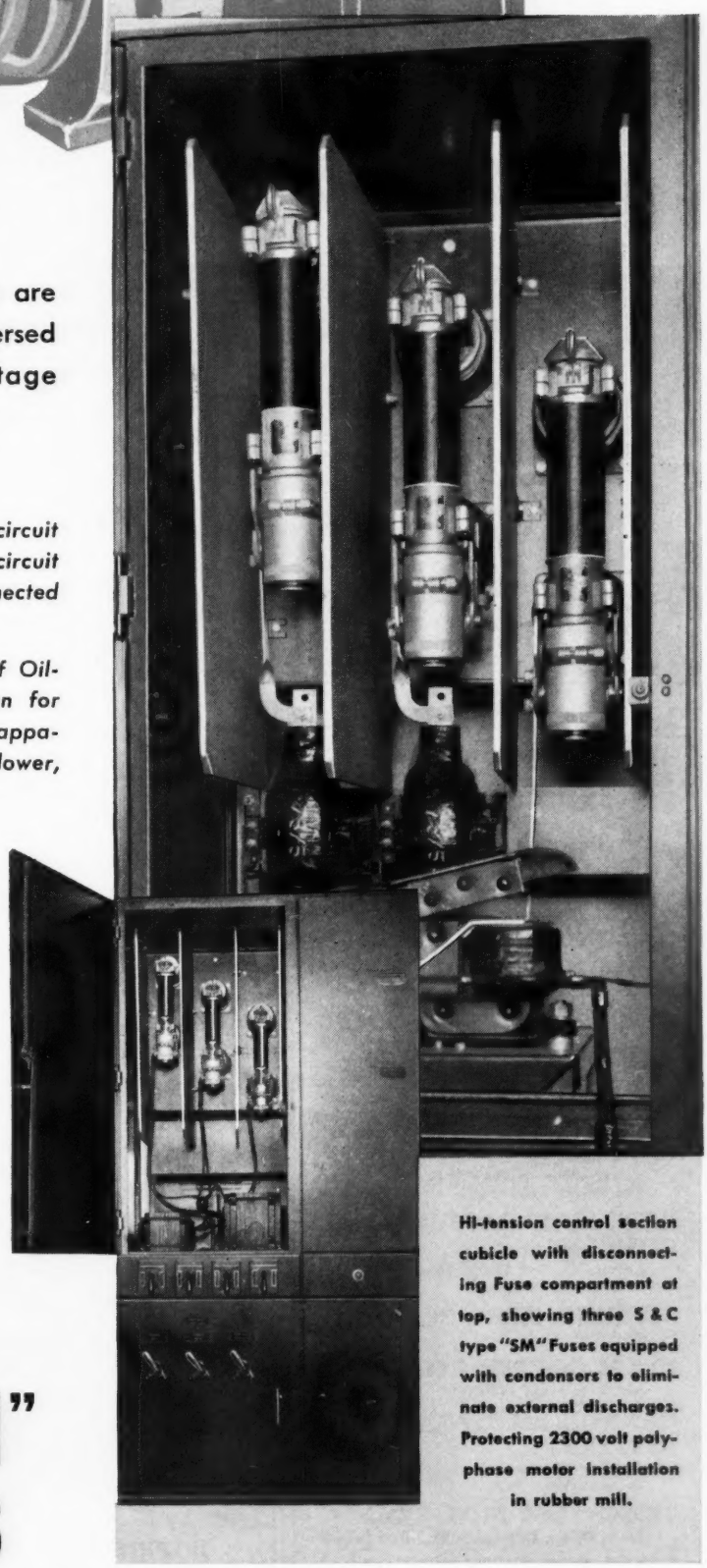
This combination has advantages of:—

1. *Power Fuse protection with the necessary short-circuit interrupting capacities to provide fast, reliable circuit interruption when faults occur in motors or connected equipment,—and,—*
2. *Starting and stopping of the motor by means of Oil-immersed Contactors. Installation is simpler than for other types of circuit interruption and control apparatus,—less critical metal is required, costs are lower, and deliveries better.*

Fuse Refill Unit, for quick replacement on the job.

Type "SM" Fuses are available with ratings of 1- to 400 amperes, 2300/4000 Volts. Interrupting capacities up to 30,000 rms amperes or 207,000 kva.

For more complete data on Power Fuses for industrial installations, send for S&C Bulletins.



Hi-tension control section cubicle with disconnecting Fuse compartment at top, showing three S & C type "SM" Fuses equipped with condensers to eliminate external discharges. Protecting 2300 volt polyphase motor installation in rubber mill.

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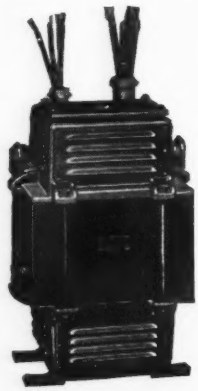

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1710 E. 57th St. Los Angeles, Calif.

FPC ORDER INVOLVES MONTANA PROJECTS

Montana Power Co. has been directed by the Federal Power Commission to show cause why it should not apply for FPC licenses for seven hydroelectric projects constructed on the Missouri River between 1891 and 1930. Also included in the order are two storage reservoirs on the Madison River, a tributary of the Missouri.

The projects, the FPC charges, are maintained and operated without benefit of rights-of-way or licenses pursuant to the Federal Water Power Act. The projects involved are Canyon Ferry constructed in 1898, 7,500 kw.; Hauser Lake, constructed in 1907, 18,000 kw.; Holter, constructed in 1918, 50,000 kw.; Black Eagle, constructed in 1891, 18,000 kw.; Rainbow, constructed in 1910, 35,000 kw.; Ryan (Volta), constructed in 1910; 60,000 kw. and Morony, constructed in 1930, 45,000 kw.

All are on the Missouri River and each includes a dam entirely across the stream. The FPC points out that the Missouri is a navigable river.

● OFFICE WORKERS in two divisions and outside workers in a third on the system of the Pacific Gas and Electric Co. will be represented by the AFL International Brotherhood of Electrical Workers in collective bargaining as a result of NLRB elections. In the Humboldt division 11 office workers voted in favor of the IBEW. In the San Joaquin Power Division the vote was 381 for the IBEW, 282 for the CIO Utility Workers Organizing Committee and 85 for neither. The results were announced by the NLRB in Washington.

● REHEARINGS have been requested by the Tucson Gas Electric Light & Power Co. of an Arizona Corporation Commission order putting into effect rate reductions totaling $175,000 annually. The order was based upon savings in power costs incident to receipt of power from Parker Dam. The company's appeal states that no consideration was given to a recent $1,200,000 increase in assessed valuation imposed by the state tax commission which has resulted in a $60,000 annual increase in taxes.

● ACTING ON ITS OWN MOTION, the California Railroad Commission has instituted an investigation of the Vallejo Electric Light & Power Co. to determine whether or not a rate reduction is in order. The Vallejo company serves the mushrooming community adjacent to the Mare Island Navy Yard.

Aviation—A Progress Report

The Lessons of War Become the Key to a Richer Peace

TUNISIA, PANTELLERIA, SICILY—stepping stones to momentous events! But that is not all. For they spell out across the blue waters of the Mediterranean a pattern of invasion that has progressed far since last summer's first major Commando operation against the French coast.

From Dieppe, you remember, too many of the raiders never got back. But in Tunisia, and on through Sicily, the Allied might plowed inexorably forward, winning objective after objective at a surprisingly low cost in casualties. Air supremacy over the battlefield? Yes. But we have learned, too, how to save lives and shorten the war by strategic air bombardment as a prelude to invasion.

Thus the bombardment plane—rarely seen by the doughboys on the fighting fronts—is destined to save their lives by hundreds of thousands in the decisive attacks that are to come. This fact is confirmed by the cold calculations of the responsible strategists. It will give renewed courage and confidence to every member of the armed forces and of the home fronts throughout the United Nations.

For instance: thorough strategic bombardment of an objective reduces by nearly fifty per cent the surface forces required for invasion. Anticipated losses are reduced from more than fifty per cent of the original ground force to about twenty per cent. Precision bombardment—as used on railroad objectives in Rome—reduces this percentage of loss still further when it is followed by offensive action on the ground.

This is the fifteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

The inference is clear. Effective prosecution of the war will require smaller ground combat forces and much larger air forces than some of our strategists once thought.

Our most urgent need, then, is for ever-mounting fleets of aircraft. And, fortunately, this is just what we are getting. The American aircraft industry now is producing as many airplanes as all the rest of the world combined. In 1938 we made 100 planes a month. Now we make three times that many in a single working day. By the end of 1943, our production rate will be about 10,000 a month.

But at this stage of the war, types of planes are more important than mere numbers. In the early months the program was heavy, and properly so, with single-engine trainers. Then, as training planes accumulated, the emphasis shifted to heavier types. Now we are turning out multi-engined bombers at a rate that is the envy of the entire world. Some months ago the President revealed that we were manufacturing 500 long-range bombers every month. The figure was conservative even then. And soon we shall be producing planes of this one type at a rate adequate to replace the normal losses of a fleet of at least 1000 American heavy bombers operating as continuously as the weather will permit.

A glimpse of the poundage production may help us still further to evaluate the miraculous achievements of the aviation industry as a whole. It was 89,000,000 in 1941 . . . 291,000,000 in 1942 . . . 911,000,000 in 1943 . . . and 1,417,000,000 in 1944

– if we need it. There you have the magnificent record of the American aircraft manufacturing industry – a monument to the cooperation of industry, labor, government, and to all-out teamwork between the aviation industry and those other industries which have converted their facilities to the manufacture of airplanes.

What of our enemies and our Allies?

German production probably has flattened out at 2500 a month – with downward revision in immediate prospect. Japan may be able to produce as many as 1000 planes a month – until we get our new long-range super-bombers in sufficient numbers to whittle down that figure. Italy may be able to turn out her 500 a month – for a little longer. At best the maximum Axis monthly total is 4000.

Add to our monthly score of nearly 8000, a total of approximately 4000 for Britain, Canada and Russia, and the United Nations score comes to 12,000 monthly. There we have a three to one advantage for our side. And between our own rising production and the brilliant operations of our bomber commands we should soon boost the ratio well above that figure. Therein lies the certainty of continued and growing air superiority over all the far-flung battlefields.

The critics of American airplane quality have been silenced ever since the ratio of enemy combat losses to our own on bombardment missions surpassed four to one. In the Pacific where our heavily armed and armored planes are knocking off the desperately stripped racing craft of the Nipponese, enemy losses often run as high as eight to one or more. In the Mediterranean theater, where the Italians were abandoned by their Allies, the story is much the same. Only in the well-defended homeland of the Nazis do we sometimes drop below the average, but even in those rare instances the ratio is still well in our favor and the effectiveness of our bombardment is adding constantly to our margin.

* * *

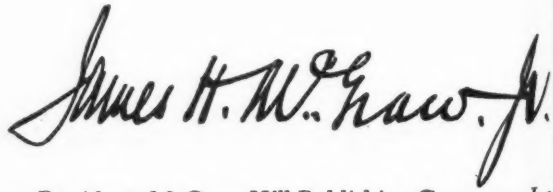
Behind the production lines the battle of research and design still rages. In many a laboratory night-shift, on many a secret test field, new and terrible surprises for the enemy are in the making. Super-bombers, destined for Tokyo, have long since passed out of the design stage and the Japanese may learn about them almost any day. New discoveries, designed to sow swift and silent devastation, are farther along than our enemies believe. No longer will fog or storm or night be permitted to fight on the side of our foes.

The men of science who are toiling to broaden the horizon of our knowledge stand today on the threshold of discoveries that have been sought for centuries. New reservoirs of power may soon exert a profound influence in many fields of technology and through them on our way of life.

Once the war is won these new discoveries will be translated into better living. No longer will countless thousands spend their lives within their own communities or countries. New efficiencies in transportation will bring world travel within the reach of many who once had to stay at home. New family vehicles will navigate the skyways as easily and safely as the highways. Already more than a dozen manufacturers of airplanes, ships, automobiles, and electrical equipment are designing, building, or flying rotary-winged aircraft such as the helicopter or autogyro to meet the needs of tomorrow's families. New and safer aircraft of the fixed-wing type are ready for production as soon as materials become available.

The quality that now makes each of our war planes worth so many of those built by our enemies will be translated into the sturdy reliability demanded by peacetime operation. The devices that seek out and find our enemies behind the veil of fog or darkness will, after the war, reduce weather hazards to the point where they will be no greater in the air than on the ground.

Science and industry will continue to do their jobs and do them well. But if the world is to be made a better place for men to live in, statesmanship must not fail to do its part.



President, McGraw-Hill Publishing Company, Inc.

S-h-h... it's a "civilian secret"!

New, improved MILLER 50 FOOT CANDLER and 100 FOOT CANDLER Continuous Fluorescent Lighting Systems coming back—look for the BIG NEWS here next month!

Three years ago we introduced the first continuous fluorescent lighting systems — MILLER 50 AND 100 FOOT CANDLER.

This meant that for the first time industry really could have adequate man-made daylight *indoors* — of 30, 50 or more footcandles — for better, faster, safer production.

This meant considerable *installation savings*—both time *and* dollars—over conventional incandescent or fluorescent fixture hookups. Savings of from 30 to 50% as a matter of fact.

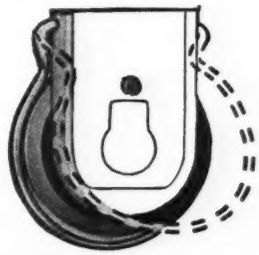
This meant *simplified lighting maintenance* — reflectors so easy to remove, handle and clean that women workers could take care of them.

Then war hit! And, cockeyed as it sounds, the very production requirements which this better lighting served so well created shortages in metals and other vital materials that temporarily cramped our style.

Now MILLER engineers have licked those headaches — and they're bouncing back with a new, and further improved 50 FOOT CANDLER AND 100 FOOT CANDLER that's going to give you all these lighting benefits to help you with your production and manpower problems.

If your war demands are so great you can't wait, drop us a line and we'll see what advance dope we can send you now.

THE ABOVE LIGHTING LAYOUT *will give you a faint hint of what's coming — an improved, streamlined version of the most successful lighting system in use in industry today — and pioneered by* MILLER.



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Among many noteworthy MILLER *fluorescent features is this patented* safety lamp lock *that minimizes the danger of lamps falling. It is an integral part of each socket, simple in operation, foolproof, and sound accident insurance.*

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Forgings offer many direct and indirect economies. Consult makers of drop forged pole line hardware.

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NO ADDITIONAL CAPACITY FOR BIG THOMPSON

Additions to the Colorado-Big Thompson project recently authorized by the WPB will not involve more power generation at the present time. Present construction, according to S. O. Harper, chief engineer of the USBR, will consist of completion of the transcontinental divide tunnel, construction of the North Fork diversion dam and erection of a wood stave siphon at the east portal of the tunnel.

Only 2½ miles of the 13.1-mile Adams tunnel remain to be bored. The North Fork dam will divert waters from the North Fork of the Colorado River into Grand Lake and thence to the east side of the continental divide.

Up to the present only the Green Mountain Dam and power house have been completed. Power from the latter station's two 13,000-kva. units is being absorbed into the Public Service Co. of Colorado system.

Twenty-Seven Utility Jobs On "Critical" List

Twenty-seven electric utility industry jobs are included in the list of 140 critical occupations which the War Manpower Commission has announced will give fathers extra opportunity for occupational draft deferment. The new list is part of the WMC program of keeping essential workers frozen to their jobs and forcing non-essential workers into war jobs or services.

Electric utility occupations listed as critical under the new order include: Blacksmith, all around; boilermaker, all around; bricklayer, refractory brick; cable splicer, telephone, telegraph or submarine; electrical tester, power equipment; electrician, installation and maintenance, all around; engineer, turbine or diesel; engineer, professional or technical; engineering draftsman, design; foreman; inspector; instructor; lead burner, all around; lineman, telephone, telegraph or power, all around; load dispatcher, power or gas; machinist, all around; radio communications technician; refrigerator equipment repairman, gas or electric, all around; sheetmetal worker, marine, all around; switchboard operator, power; cable transmitter and receiver; electrician, aircraft, marine, power house or submarine cable, all around; instrument maker and repairer, electrical, mechanical or scientific; jointer, submarine cable; mechanician, communications equipment; supervisor, and x-ray equipment serviceman.

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Solderless, Tapeless, Wire Connectors

UNRESTRICTED
MEET ALL GOVERNMENT REQUIREMENTS!

Solder joints are prohibited by government order wherever another product meeting electrical requirements can be used—but IDEAL "Wire-Nuts" are not prohibited. "Wire-Nuts" fill the bill 100%. They use none of the critical materials—tin, lead, or rubber—required for solder and tape joints. Make a neater, safer joint; Better Electrically—Stronger Mechanically. Fully Approved. Listed by Underwriters' Laboratories, Inc. Sizes for every job. Write for free samples.

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Small Diameter FLAMENOL* BUILDING WIRE

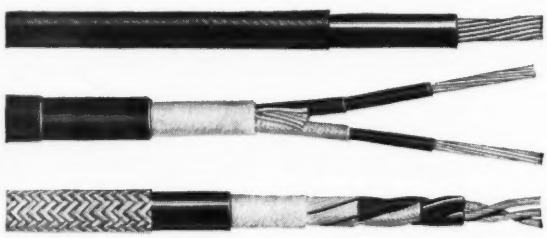
TYPE SN

Again thermo-plastic small diameter Flamenol Building Wire is available for war-purpose wiring. The available supply of resins has improved. They are permitted for electrical conductor insulation wherever copper is allocated.

Use this easy-to-handle, dependable wire for maintenance jobs, for rewiring and for new wiring. Its small diameter permits more wires to be used in conduits for both rewiring and new wiring. Its insulation is superaging, high in dielectric and mechanical strength, flame retarding and resistant to moisture, oil, acid, etc. It is available in sizes 14 and larger which enables it to be used for feeders as well as branch circuits.

FOR FURTHER INFORMATION on Flamenol Building Wire, G-E Small-boat Cables, conduits or wiring devices, see your G-E Merchandise Distributor or write to Section CDW-933-18, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

G-E SMALL-BOAT CABLES

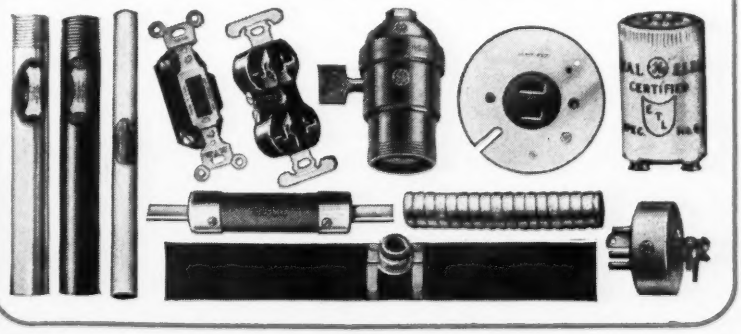


G-E Small-boat cables are designed especially for use on the small boats being built for the U.S. Government's boat building program. They are available with one, two, three or four stranded copper conductors and are well designed and carefully made. The conductors have Flamenol* insulation. Cotton fillers are cabled with the conductors under a Flamenol* sheath. This sheath is resistant to oil, gas, acid, sunlight, salt water, etc. Over-all is a moisture-resisting and flame-retarding cotton braid. (Galvanized steel braid with aluminum paint on armored cables.) G-E Small-boat Starter Cables are also available.

*Reg. U.S. Pat. Off.

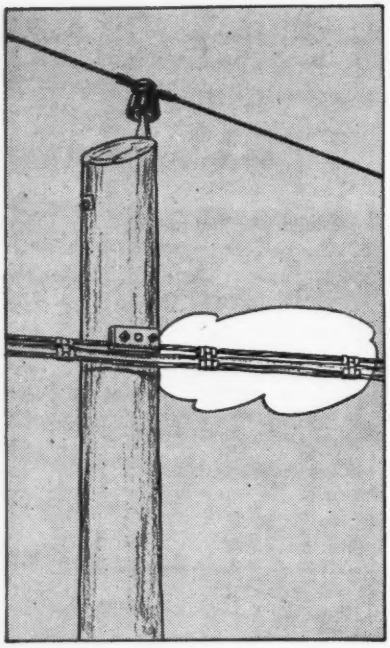
G-E WIRING DEVICES AND CONDUITS

General Electric offers five conduits and hundreds of wiring devices for war jobs including: G-E White zinc covered conduit, G-E Black enamelled conduit, EMT, flexible metal conduit; and switches, lampholders, outlets, fuses, etc.

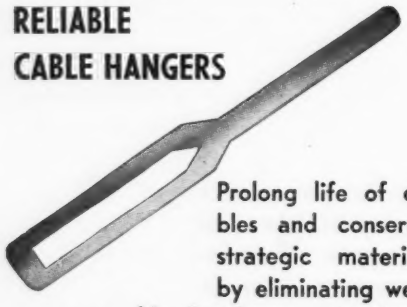


GENERAL ELECTRIC

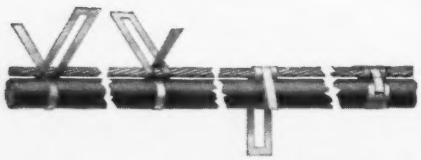
Reduce Outages
Avoid Cable Wear
Reduce Maintenance



RELIABLE CABLE HANGERS



Prolong life of cables and conserve strategic materials by eliminating wear on cable sheaths or on insulation of hand made cables. Reliable cable hangers hold cable and messenger together tightly with wide bearing surfaces which eliminate snaking and chafing. They are easily applied and make installations that are permanent and very neat



Reliable
ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE · CHICAGO, ILLINOIS

PEOPLE
made this news

PG and E Promotes Downing and Wishon

At a recent meeting of the board of directors of Pacific Gas and Electric Co., P. M. Downing was appointed executive vice-president of the company and A. E. Wishon was made vice-president and general manager to succeed Downing who had occupied that position for the past fourteen years. In addition to specific assignments, Downing will assist President J. B. Black in general supervision of the company's affairs.

Wishon stepped to his new position from that of vice-president and assistant general manager, which post he has held for the past thirteen years.

Downing was superintendent of substations and operating engineer of one of the companies merged to form PG and E in 1905, and continued in that position with the newly formed company until 1908, when he was made engineer of operation and maintenance. In 1917, he was named chief engineer and in 1920, vice-president in charge of electric operation. Subsequently he was made vice-president in charge of electric construction and operation. In 1929, he was appointed vice-president and general manager, which position he held at the time of his recent advancement.

Wishon started his utility career with the Kaweah Water and Electric Co. In 1910, he joined the San Joaquin Light & Power Corp. as assistant general manager of the southern division and was made assistant general manager of all properties in 1913. In 1920, he became general manager. In 1930, when PG and E acquired control of the San Joaquin company, Wishon became vice-president and assistant general manager of PG and E, at the same time serving as president and general manager of the San Joaquin Light & Power Corp., until 1938, when the two companies were merged.

Both Downing and Wishon also are members of the Board of Directors of PG and E.

● Several Personnel Changes in the Southern California Edison Co. became effective recently. R. E. Fife, tax agent, was appointed executive assistant. E. R. Peterson succeeds him as tax agent. G. R. Woodman assumed the post of acting superintendent of hydro-generation. J. Bruce was appointed station chief at Long Beach steam station, and J. J. McDade assistant station chief.

DOWNING

Jacobson Goes to G-E Oakland Works

Peter C. Jacobson has been appointed engineer and superintendent of the General Electric cable division at its Oakland Works. He formerly was with the cable department at Schenectady.

Jacobson was graduated from Washington State College in 1929 and joined G-E at Schenectady during the same year. In 1935 he was made assistant to the superintendent of the wire department at Schenectady and later was promoted to general foreman of the cable department.

● John V. Jann is now lieutenant (j.g.) U. S. Navy, and has been sent to radar college at Brunswick, Maine. He was formerly in Portland.

WISHON

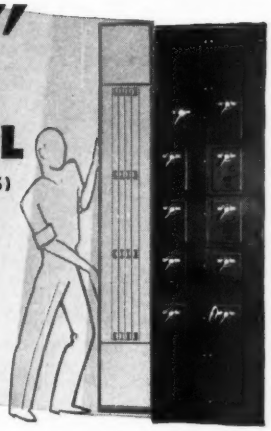
TRUMBULL-PIONEERED

"packaged"

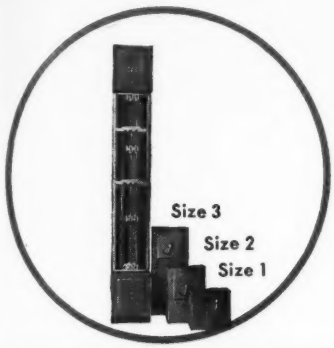
POWER CONTROL

(PREFABRICATED SWITCHBOARDS)

MAKES CONTROL CENTER INSTALLATION

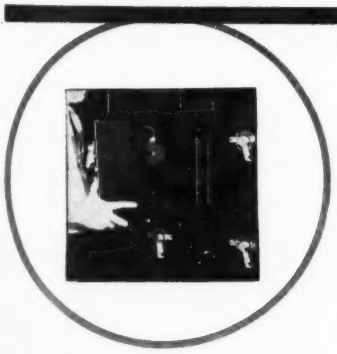


Simple as **a b c**



a ORDER STANDARDIZED STOCK SECTIONS AND UNITS . . .

b ASSEMBLE & GROUP SECTIONS TO FIT YOUR NEEDS . . .



c PLUG-IN REQUIRED CONTROL UNITS FROM FRONT

SAVES TIME . . . It used to take plenty of careful engineering and weeks of installation time to lay out power wiring and control equipment for a factory . . . until Trumbull pioneered application of the CONTROL CENTER idea. Now the engineering has already been done, and done well . . . on our time, not yours. You buy "packaged" units right out of stock. They are assembled, with almost "building block" simplicity, to give exactly the right combination of centralized switchboard or motor control equipment for your job . . . ready for power weeks or months sooner than possible under old-time schedules.

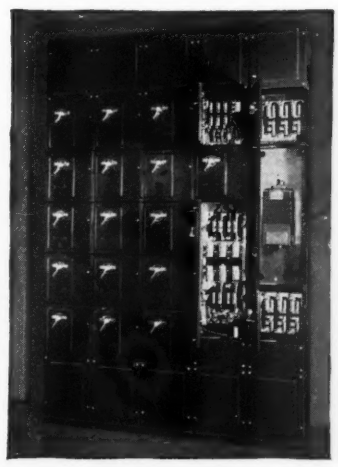
SAVES MATERIALS AND SPACE . . . Centralized Trumbull Control Center installations simplify feeder and machine wiring layout...use far less critical materials for a given load capacity, prevent waste in conduit and cable use. In large plants, control centers can be located centrally in production areas, BACK TO BACK OR AGAINST WALLS . . . requiring minimum space, all units, parts, and wiring connections ACCESSIBLE FROM FRONT . . . exclusive Trumbull features.

ASSURES FUTURE FLEXIBILITY . . . Vertical sections and interchangeable PLUG-IN TYPE control units provide flexibility never before possible . . . yet an exceedingly important factor in every plant today. Major revamping of an entire plant set up becomes possible by merely adding, subtracting or regrouping units and sections without any of the costly tie ups such work would ordinarily entail. Control Center installations made today provide the flexibility essential to war production and to later post-war reconversion.

This page merely covers the highlights. New Trumbullaid Bulletin No. 411 gives all the facts. Write for your copy today.

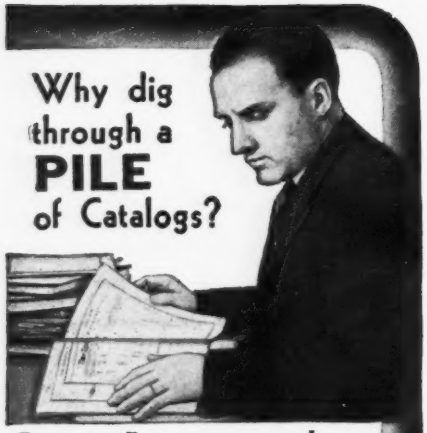
TRUMBULL

CONTROL CENTERS



THE TRUMBULL ELECTRIC MANUFACTURING COMPANY PLAINVILLE, CONN. A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

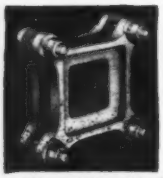


Find the Fitting you need—quickly—in the COMPLETE line

If you have a Penn-Union Catalog, you can instantly find practically every good type of conductor fitting. These few can only suggest the variety:

Universal Clamps to take a large range of conductor sizes; with 1, 2, 3, 4 or more bolts.

L-M Elbows, with compression units giving a dependable grip on both conductors. Also Straight Connectors and Tees with same contact units.

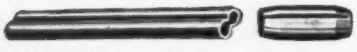


Bus Bar Clamps for installation without drilling bus. Single and multiple. Also bus supports — various types.

Clamp Type Straight Connectors and Reducers, Elbows, Tees, Terminals, Stud Connectors, etc.

Jack-Knife connectors for simple and easy disconnection of motor leads, etc. Spring action — self locking.

Vi-Tite Terminals for quick installation and easy taping. Also sleeve type terminals, screw type, shrink fit, etc. etc.



Splicing Sleeves, Figure 8 and Oval, seamless tubing—also split tinned sleeves. High conductivity copper; close dimensions.

F. M. NICHOLAS CO.
1123 Harrison St., San Francisco

KENNETH ANDERSON CO.
334 East 4th St., Los Angeles

NORTHWESTERN AGENCIES
2411 First Ave., Seattle, Washington

Penn-Union Electric Corp., Erie, Pa.

PENN-UNION
Conductor Fittings

Nims Coordinator for War Aid Program in Mountain Area

Appointment of L. W. Nims, Utah Power & Light Co., as intermountain region coordinator for the national utilities wartime aid program has been announced by the Ninth Service Command. For the past three years Nims has been assisting the Army to utilize Utah Power & Light Co. facilities and will continue as coordinator for the utility.

His new duties will include the working out of a program of mutual assistance between Army establishments and electric utilities of Utah, Idaho and Montana. Under this program, which is nation-wide, a coordinator from each electric utility serving an Army establishment will work with the post engineer of each camp.

Utilities will furnish technical advice and will cooperate in normal maintenance of electrical facilities; will aid in safety and lineman training; will advise on inspections, blackouts and equipment. Post maintenance crews will aid the utilities under emergency conditions on utility lines serving the post. During emergencies there will be interchange of equipment and materials.

● THOMAS C. MCFARLAND has been appointed chairman of the department of electrical engineering at the University of California succeeding Dr. L. F. Fuller who recently resigned from the U. C. staff. Dr. Fuller has joined the engineering department of the Joshua Hendy Mfg. Co. at Sunnyvale.

● JAMES M. GAYLORD, chief electrical engineer of the Metropolitan Water District of Southern California, has been elected vice-president of the American Institute of Electrical Engineers, representing the Pacific district, which includes California, Arizona and Nevada.

● F. I. LAWSON, who since 1925 has been with the Federal Power Commission in Chicago, New York and Washington, D.C., is now with the Braden Copper Co. at Rancagua, Chile. Prior to 1925 he had been with Pacific Gas and Electric Co. in the Bureau of Tests and in several of its divisions.

● FRED FATKIN has joined the Y. M. C. A. and is expected to engage in war organization work and to be stationed at Esquimalt. He has been associated with the B. C. Electric Railway Co. at Vancouver for many years, first as an appliance salesman and then as district manager for vacuum cleaners. He was subsequently British Columbia manager for the manufacturers of Royal Cleaners and comparatively recently returned to the B. C. Electric in the customer's service department.

NIMS

Cordiner Takes Post With General Electric Co.

Appointment of Ralph J. Cordiner as assistant to the president of General Electric Co. was announced last month by President Gerard Swope. Cordiner was manager of G-E's appliance and merchandise department when he resigned in 1939 to become president of Schick, Inc., a post which he left last January to serve the War Production Board.

He is well known in the West, where he went to work for Pacific Power & Light Co. while still a student at Whitman College in Walla Walla, Wash. Following graduation he was with Pacific for a time, then went with Edison General Electric Appliance Co., first in the Portland office and then successively as Northwest manager and Pacific Coast division manager.

Bashore Receives Appointment As Reclamation Bureau Chief

Harry W. Bashore has been appointed commissioner of the Bureau of Reclamation to succeed John C. Page, whose recent resignation was forced by ill health. Bashore had been acting commissioner since last April.

Appointment of William E. Warne as assistant commissioner was announced at the same time. Warne was formerly with the bureau but recently had been director of information for the Department of the Interior.

LET "Assistant Cables" CARRY PART OF THE LOAD

If your insulated power cables are loaded to their limit and there is a demand for more service, you must do something about it. In times like these your decision what to do will be influenced by shortage of materials, military requirements, priorities, and manufacturing restrictions.

You may find that instead of replacing an old cable with a larger one, better results can be obtained by installing an "assistant cable" in parallel with that now in service. If that can be done you will not only keep your old cable in service but you may carry your full load with less copper than would be required for complete replacement of your present cable installation.

To get best results, any cables you buy should be designed by cable engineers to fit the job they are to do and at the same time to get maximum use of the critical materials that go into them. If you need cables for essential work let us tell you more about Simplex cables.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex
WIRES and CABLES

PACIFIC COAST OFFICES

390 Fourth St., San Francisco, Calif.
910 East Third St., Los Angeles, Calif.
503 Polson Bldg., Seattle, Wash.

This
NEWSPAPER
advertisement was published in Washington, New York and Chicago by McGraw-Hill, to make friends for business.

Have you ever been out of a job?

What you can do

The best way to insure good jobs and better living is to create an environment favorable to continuous industrial progress.

The best way to insure healthy industrial progress is through a nation-wide understanding of the fact that we live better through doing more work in less time.

Nation-wide understanding of that fact will result in laws that encourage industrial progress.

Nation-wide understanding always will be a will-o-the-wisp, unless each business man does his share of: (1) Understanding his own responsibilities in maintaining industrial progress; (2) Explaining the relation between *good* business and good living to his employees and neighbors.

The newspaper advertisement reprinted here is McGraw-Hill's share in the job of explaining the source of good living. It has appeared in Washington, New York and Chicago, as well as in all McGraw-Hill publications. It is available, for use over your own company signature, in your plant city. A mat, six-column size for newspaper reproduction, will be sent to you upon request. Booklet reprints are also supplied at cost ($10.00 per thousand).

James H. McGraw, Jr.

President

McGraw-Hill Publishing Company, Inc.

IF you have ever been out of a job, and if you had a wife, children and slender resources at the time, then the fattest paycheck will never quite obscure the memory of the days and nights you lived with fear.

Some of that fear lingers in every man's mind, for all have suffered in some degree.

► That's why you hear the words "postwar planning" so often. Americans are determined that, one way or another, they are going to keep our thousands of factories going after the war, so that there will never again be a vast army of unemployed.

As usual, in a democracy, there are two entirely different ideas as to how to make 56 million jobs grow after the war, where only 46 million existed before.

Both kinds of people, who hold these different ideas, sincerely want to make the postwar world a better place for you to live in. They have complicated arguments, backed by lots of figures.

But when you trim all the arguments and figures down, you find that one side believes in DIVIDING jobs to make them go round, and the other side believes in MULTIPLYING jobs so there will be greater opportunity for all.

We believe in the MULTIPLYING plan for making postwar jobs and ask you to believe in it too.

Look back over our history. What made us great? Was it rich soil? Africa's is as rich. Was it

FREE MATS: If you would like to publish this message over your own company name, or distribute it in handy booklet form, write or wire: Research Dept., McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York (18), N.Y.

Have you ever been out of a job? (cont'd)

natural resources? China has them in abundance.

NO, the greatness and the good living of America is the direct product of her genius for doing more work in less time.

Invention is the source of improvement, and *improvement* is the multiplier of jobs . . . when products are improved in service or style, or lowered in price, new customers are attracted and new jobs created.

That's why it is true that good living has its source in industrial progress.

When industrial progress is interrupted, we have a depression, and there is less good living.

When (through courageous investment in new and better products) industrial progress is resumed, we go on to even higher levels of good living.

► If every able-bodied person in America is to have a job, then we must all understand the things that make good living possible, and we must all help *improve* the methods that have given so much good living to so many people already.

For businessmen, that means a constant search for improved methods and machines, a regular year-after-year investment in industrial progress. This means avoidance of such things as speculation in inventories that tend to create booms and depressions rather than consistent progress.

For every citizen, it means a constant search for the best ways and means to prevent and cure depressions.

Businessmen, alone, cannot prevent bad times. It's a job for *every* citizen. Every American can help just by knowing that good living comes from doing more work in less time. If you, and all other Americans, swing on to that fact, the laws that control our rate of industrial progress will be better designed to keep the improvement engine running.

That's where government really can be helpful in postwar planning.

It can encourage the "take a chance" spirit that is the basis of all progress. And it can improve the measures which prevent and cure depression. At present, our laws are not framed to encourage investment in new and better methods.

Many local, state and national taxes work out in favor of keeping an old machine, instead of buying a new one.

► There are tens of thousands of machines in the country that are over 20 years old. Even our shiny new war equipment is living 3 years in one, and will be old when the war is over.

Every machine should be regarded as obsolete as soon as it is installed and work started on a better one. In the long run, that is the best way to multiply jobs and create better living. Our laws should *encourage* the process, not *discourage* it.

New machines can only be bought with the profits created by old machines. The money that is laid aside by industry to develop and buy new machines is called "Seed Money." If laws take away too much of the Seed Money of business, that will prove disastrous. High taxes must be paid, but they should not destroy Seed Money, which is the only source of improvement.

That's why it's so important for everyone, no matter what his walk in life, to know this fundamental fact:

"Industrial Progress
is the Source of all Good Living."

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

24 publications, which gather "war-news" from the "war-production-front" through a staff of more than 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

This advertisement is available in handy booklet form. (Less than 100 copies free. Larger quantities, $1.00 per 100; $10.00 per 1000.)

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Business Publishers International Corporation, an affiliate, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation

G.C.A.

Lamp Replacers
Lamp Base Removers
Cartridge Fuse Tongs
Switch Hooks

Send for Catalogue

We have been making safety tools for 26 years

THE G. C. A. Manufacturing Co.
Pittsfield, Mass.

● R. F. BESSEY recently was named special advisor to the Bonneville staff. He formerly was Northwest regional officer of the National Resources Planning board. With the government for 24 years, he has served with the Panama Canal commission, in the War and Navy departments and in the Department of the Interior, and PWA.

● R. G. DUMMEL, in San Francisco, and FRANK VAN GILLUWE, Los Angeles, are now district managers of the Hollophane Co. in a series of new appointments made with the advancement of CLARENCE C. TELLER as sales manager of the company. Previously they were district sales engineers.

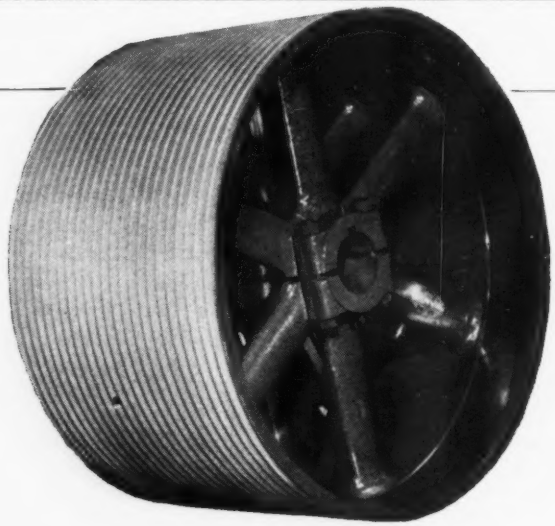
Herbert H. Benfield, former San Franciscan, has been named Eastern Division manager for BullDog Electric Products Co. Well known for his success in promoting the use, application and marketing of thin wall conduit, Benfield was on the West Coast from 1930 to 1937 as district sales manager for Republic Steel Corp.'s steel and tubes division

Clyde Seavey, FPC Member, Dies in Washington, D. C.

Clyde L. Seavey, 68, member of the Federal Power Commission died in Washington, D. C. on Aug. 5 from heat exhaustion. Mr. Seavey was president of the California Railroad Commission from 1923 to 1934 and previously served as chairman of the California State Tax Commission and on the State Board of Control and Civil Service Commission. He had been a member of the FPC for nine years and had been vice-chairman and acting chairman from 1937 to 1939.

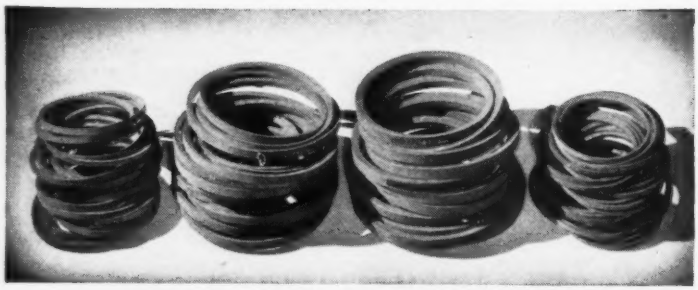
● WILLIAM J. GRAMBS, former executive of the Puget Sound Power & Light Co., of Seattle, died in that city on Aug. 17 at the age of 81 years. Mr. Grambs came to Seattle in 1887 as manager of the Northwest Electric Supply & Construction Co., later affiliating with the power company. He was a graduate of the Naval Academy at Annapolis.

● RALPH C. CLYDE, 66, Portland commissioner of public utilities, died in that city on Aug. 15. An advocate of public ownership, Clyde had been a city commissioner since 1930.



BROWNING GRIPBELT 'V'-DRIVES

Stock "A" Drives . . . . ½ to 10 H.P.
Stock "B" Drives . . . . 2 to 50 H.P.
Stock "C" Drives . . . . 5 to 100 H.P.
Stock "D" Drives . . . . 50 to 200 H.P.



MARWOOD LIMITED

REPRESENTING BROWNING MANUFACTURING COMPANY
SEATTLE · PORTLAND · SAN FRANCISCO · LOS ANGELES

★

700

WHERE TO BUY IT...
on the West Coast...

GARLAND-AFFOLTER ENGINEERING CORP.

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San Francisco 5, Calif.

Room 366
124 W. Fourth St.
Los Angeles 13, Calif.

532 First Ave., So.
Seattle 4, Wash.

1233 N.W. 12th Ave.
Portland 9, Ore.

MANUFACTURER'S REPRESENTATIVES

CHECK the FACTS—

1. Hi-Pressure, self-cleaning, spot contacts make new, clean contact surfaces with each operation.
2. Hi-Pressure annular contact hinges keep constant contact in all blade positions—keep dirt and corrosion out of contact area, eliminating scoring.
3. Individual pressure springs insure uniform contact loading.
4. Positive blade latch prevents untimely opening of blade due to short circuit stresses.
5. Shuffle pryout releases pressure in opening.

R&IE

DISCONNECTING SWITCH

The Check list

CONDUCTOR SUPPORTS CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

AIR BREAK SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SECTIONALIZING EQUIPMENT

METAL CUBICLES

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RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

for CONTRACTORS and INDUSTRIAL PLANTS, it's

TRICO

FUSE PULLERS

For cheap insurance against accidents, shock, burns, infection, use a TRICO FUSE PULLER. Install them on all jobs.

Write for Bulletin No. 5

TRICO

KLIPLOKS

Lock like a vise!
They eliminate:
- Unnecessary shutdowns
- Premature fuse blowings
- Wasted current
- Night and holiday repairs

Install KLIPLOKS everywhere

WRITE FOR BULLETIN No. 6
COAST REPRESENTATIVES
W. E. Young Co., 1944 Broadway, Denver
H. H. Van Luven, 307 E. 3rd St., Los Angeles
Albert S. Knight, 3006 Western Ave., Seattle
Pacific Industrial Products Co.
9th & Harrison Sts., Oakland, California

TRICO FUSE MFG. CO., Milwaukee, Wis.

SMOOT-HOLMAN

SMOOT-HOLMAN COMPANY
SIGHT-CRAFT
INGLEWOOD CALIFORNIA

LUMINAIRES FLUORESCENTS
REFLECTORS FLOODLIGHTS

INDUSTRIAL AND COMMERCIAL LIGHTING EQUIPMENT

HOME OFFICE AND FACTORY
INGLEWOOD, CALIFORNIA

SAN FRANCISCO OFFICE & WAREHOUSE
460 7th Street, San Francisco, Calif.

REPRESENTATIVES
FRED ZAUGG, 907 N.W. Irving St., Portland, Ore.
COAST SALES CO., 307 Main Street, Seattle, Wash.
STEVENS SALES CO., 41 Post Office Place, Salt Lake City, Utah

TRADE notes

Meyberg Gets Manufacturing Franchise from National

Leo J. Meyberg Co., San Francisco and Los Angeles distributors of electric and electronic supplies, has been given an exclusive manufacturing license for the seven Western states by National Transformer Co. of Patterson, N. J. The franchise covers the National No. 999 fluorescent lighting transformer, which eliminates mechanical starters.

Meyberg has appointed the Gardner Electric Mfg. Co., Emeryville, Calif. to manufacture the transformer and the Tru-Ad Co. of Los Angeles to manufacture fixtures. Tests on improvements and new features recently incorporated into the transformer design were completed last month at the Underwriters' laboratories and large volume production was expected to start about Sept. 1, it was announced.

According to the announcement, Gardner has redesigned and reengineered the original National circuits to improve the electrical characteristics. The unit now draws .9 amp. at 118 volts with a power factor above 90%. In addition to the original features of instantaneous, low voltage and low temperature starting, Gardner electric engineers have eliminated all compound from the ballast, to overcome melted compound due to overheating.

Paine Co. Announces New Representatives On Coast

The Paine Co., Chicago manufacturers of hanging and fastening devices, announces the appointment of the following Pacific Coast representatives:

The Milnic Co., 119 Harrison St., San Francisco, 3, will handle the line in Fresno and Northern California, and in Nevada north of Las Vegas.

H. H. Van Luven, 307 E. Third St., Los Angeles, 13, will cover Bakersfield and southern California and Arizona.

W. W. Wheat & Sons, 560 First Ave., S., Seattle, 4, will serve Washington, Oregon, Idaho and western Montana.

● TURPIN'S, pioneer electrical dealer in Fresno, Calif., has moved from the downtown store at 1321 Fulton to its residential home furnishings and furniture store at 1028 N. Fulton.

USE Mailway Banking

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For the convenience of your business or household — a Mailway checking account. For safe and systematic accumulation of a cash reserve—a Mailway savings account. Both are available to you, affording quick reliable service from one of the oldest and strongest banks in the West. Open a Mailway account today.

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American Cross-Arm, Inc.
Cross-Arms, Hardwood Pins and Moulding

Bartlett Mfg. Co.
Tree Trimming Equipment

Burndy Engineering Co.
Connectors and Lugs—All Types

Columbia Electric Mfg. Co.
Crompton Tong Test Ammeters

Cornell-Dubilier Electric Corp.
Capacitors for Power Factor Correction

T. J. Cope, Inc.
Underground Tools & Equipment

Herman D. Steel
Meter Jewels

Kellems Co.
Cable Grips for Pulling and Permanent Support.

Minerallac Electric Co.
Insulating Compound, Clips, Hangers and Statiscopes

Schweitzer & Conrad
Fuses and Protective Devices

Specialty Device
Cone Anchors, Guy Guards and Earth Augers

The States Company
Test Blocks and Meter Testing Equipment

R. Thomas & Sons Co.
Pin-type and Suspension Insulators

Electroline
Wire Rope Fittings

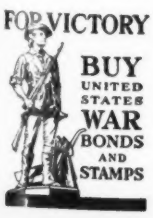
Some of us can't tell identical twins apart, but if you know them intimately you generally find differing personalities. Frequently one is stronger and healthier than the other--even though they may *look* alike!

Another case of "identical twins" would be two station insulators of different manufacture. They are exactly alike in physical qualities and appearance. But they, too, have personalities--some stronger and healthier than others.

A lot of the strength and health and personality of station insulators is a family inheritance. O-B insulators come from good stock...The same fine materials, manufacturing methods, and human skill that go into O-B suspensions, pintypes, and bushings are present in O-B station insulators. They are good because they come of a good family; a fact that is generally recognized throughout the electrical industry.

Another fact, still more important, is that most purchases of O-B station insulators are made by previous users who have learned for themselves that there's a lot under the skin of an insulator--that they *aren't* all alike, and that those branded with "O-B" will take what comes and keep delivering the goods

You can assume correct size and shape in any station insulator, but if you want those hard-to-get intangibles that can't be specified, merely write "O-B" on your order.



Ohio Brass

MANSFIELD, OHIO 2435-H

Canadian Ohio Brass Company, Ltd., Niagara Falls, Ont.

FOR SALE

30 K.W. Motor-Generator Set

Allis-Chalmers serial 90543-4. Mounted upon common base. Direct connected motor 45 hp., 3 phase, 60 cycle, 440 volts, 1160 r.p.m.

Generator—D.C. 125 volt, 240 amps., 1160 r.p.m., 6 pole.

Available for immediate shipment from Los Angeles. Private owner, O.P.A. regulations to govern sale.

Box 96, Electrical West, 601 W. 5th St., Los Angeles 13, California

TORK CLOCKS

THE POPULAR TIME SWITCH LINE KNOWN EVERYWHERE

NOW—lower prices and higher capacities

There is a Tork Clock for every regular switching job: 60 minute, 4 hour or daily cycles.

Bulletins on request

THE TORK CLOCK CO., Inc.
MOUNT VERNON, N. Y.

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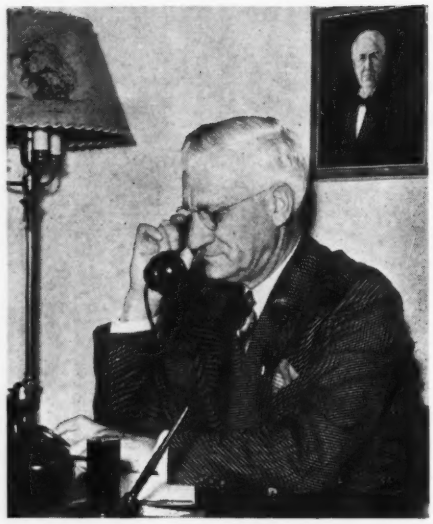
H. M. Sayers, 1101 Eastlake Ave., Seattle
Stevens Sales Co., 41 P.O. Place, Salt Lake City
Felix Simon, P. O. Box 614 . . . . . Denver
H. Geo. Shefler, P. O. Box 1587 . . . Phoenix



Answer to "Who Am I?"

See Page 76

G. H. P. Dellmann

● War Products of the United States Rubber Co. were shown at a two-day private viewing at Hotel St. Francis, San Francisco, Aug. 18-19. Fred Benz, district manager, wire sales, Pacific Division, was among the hosts. Combat types of wire and electrical fittings were among the numerous rubber and metal products shown.

Member A.I.E.E

JULIEN H. DAVIS
Consulting Engineer
Industrial
Utility-Electrical-Mechanical

740 So. Broadway Los Angeles, Calif.

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Electriquiz Answers

1. The voltage of a bolt varies with the length of the stroke, and a stroke may range from 100,000,000 volts to 10,000,000,000 volts. The current varies in different strokes from as little as 2,000 amp. to 200,000 amp.

2. The stored energy of the 10,000,000 volt discharge was approximately 165,000 watt seconds. That amount of energy would operate the average vacuum cleaner for approximately 20 minutes.

3. The stroke appearing to most of us as a single stroke generally consists of successive flashes which may endure for as long as 1½ seconds. The time required for a single discharge varies widely but an average of 100 microseconds is probably reasonably accurate. Most of us cannot appreciate the smallness of one-millionth of a second, but we can appreciate it better when it is stated that an object moving at the rate of 1,000 m.p.h. would move 1/16 in. in one millionth of a second.

4. Heat lightning is not a peculiar type of lightning phenomenon but simply a storm that is far enough away that the sound of thunder is not audible. Because of the distance the path of the stroke is obscured.

5. One of the poorest places for a human being to find himself in a storm is in swimming. Many persons have met their death because they have failed to leave the water when swimming during a storm.

6. The mere fact that lightning has struck in a certain place is proof that it can strike again, conditions being the same. Tall buildings are struck repeatedly, whereas low objects are seldom struck more than once because chance plays such a great part in determining the path of a discharge.

7. An individual should simply carry on with the ordinary routine of living but keep away from wires or large metal objects.

8. A piano is a large metal object and hence should be avoided during a storm. A large metal object could acquire a large induced potential-bound charge which would be released at the moment of a lightning stroke nearby.

Your Bond Selling Responsibilities Double!

Starting September 9th, your Government will conduct the greatest drive for dollars from individuals in the history of the world—the 3rd War Loan.

This money, to finance the invasion phase of the war, must come in large part from individuals on payrolls.

Right here's where YOUR bond selling responsibilities DOUBLE!

For this extra money must be raised *in addition* to keeping the already established Pay Roll Allotment Plan steadily climbing. At the same time, every individual on Pay Roll Allotment must be urged to dig deep into his pocket to buy *extra* bonds, in order to play his full part in the 3rd War Loan.

Your now *doubled duties* call for these two steps:

1. If you are in charge of your Pay Roll Plan, check up on it at once—or see that whoever is in charge, does so. See that it is hitting on all cylinders—*and keep it climbing!* Sharply increased Pay Roll percentages are the best warranty of sufficient post war purchasing power to keep the nation's plants (*and yours*) busy.

2. In the 3rd War Loan, every individual on the Pay Roll Plan will be asked to put an *extra two weeks salary* into War Bonds—over and above his regular allotment. Appoint yourself as one of the salesmen—and see that this sales force has every opportunity to do a real selling job. The sale of these *extra* bonds cuts the inflationary gap and builds added post-war purchasing power.

Financing this war is a tremendous task—but 130,000,000 Americans are going to see it through 100%! This is their own best *individual* opportunity to share in winning the war. The more frequently and more intelligently this sales story is told, the better the average citizen can be made to understand the wisdom of turning every available loose dollar into the finest and safest investment in the world—United States War Bonds.

★ ★ ★

BACK THE ATTACK With War Bonds!

This space is a contribution to victory today and sound business tomorrow by ELECTRICAL WEST

INDEX TO ADVERTISERS

September, 1943

Allis-Chalmers Mfg. Co. 34, 35
Anaconda Wire & Cable Co. 85
Biddle Co., James G. 39
Blaw-Knox Co. 29
Brewer-Titchener Corp., The 3
BullDog Elec. Products Co. 32
Burndy Eng'g Co., Inc. 27
Chance Co., A. B. 90
Classified 108
Crocker First National Bank 106
Davis, Julien H. 108
Driver-Harris Co. 108
Driver Co., Wilbur B. 92
Drop Forging Ass'n. 96
G. C. A. Mfg. Co. 104
General Electric Co.
Bridgeport 24, 86, 97
Cleveland 18, 19
Schenectady 1, 4, 5, 13
Guth Co., The Edwin F. 83
Helwig Company 96
Honn Co., Geo. E. 106
Hotpoint (Edison G-E Appliance Co., Inc.) Electric Kitchens 22, 23
Ideal Commutator Dresser Co. 96
Indiana Steel & Wire Co. 8
Irvington Varnish & Insulator Co. 28
Jeffries Transformer Co. 92
Johns-Manville Corp. 37
Kearney Corp., James R. 81
Klein & Sons, Mathias 12
Line Material Co. 42
Lloyd Products Co. 30
Locke Insulator Corp. 78, 79
Marwood, Limited 104
Matthews Corp., W. N. 36
Meyberg Co., Leo J. 16
Miller Company, The 95
McGraw-Hill Publ. Co., Inc. 102, 103
National Carbon Co., Inc. 6
National Tel. Supply Co. 30
Ohio Brass Company 107
Okonite Company, The 7
Okonite-Callender Cable Co. 7
Pacific Coast Elec'l Bureau ..... 4th Cover
Pacific Gas and Electric Co. ..... 3rd Cover
Penn-Union Elec. Corp. 100
Railway & Industrial Eng'g Co. 105
Ray Lite Glass Co. 88
Reliable Electric Co. 98
Sangamo Electric Co. 87
Schweitzer & Conrad, Inc. 91
Shell Oil Company 41
Simplex Wire & Cable Co. 101
Smoot-Holman Co. 106
Southern California Edison Co. Ltd. ..... 2nd Cover
Square D Company 25
Sylvania Elec. Products Co. 33
Thermador Elec'l Mfg. Co. 38
Tork Clock Co. Inc. 108
Treasury Department 109
Trico Fuse Mfg. Co. 106
Trumbull Elec. Mfg. Co. 99
Tru-Ad Company, The 15
Union Carbide & Carbon Corp. 6
Union Oil Co. of Calif. 26
United States Rubber Co. 10, 11
Van Luven Co., H. H. 102
Victor Insulators, Inc. 20
Ward Leonard Elec. Co. 20
Westinghouse Elec. & Mfg. Co. 9, 17, 21, 31, 89
Wiremold Company, The 14

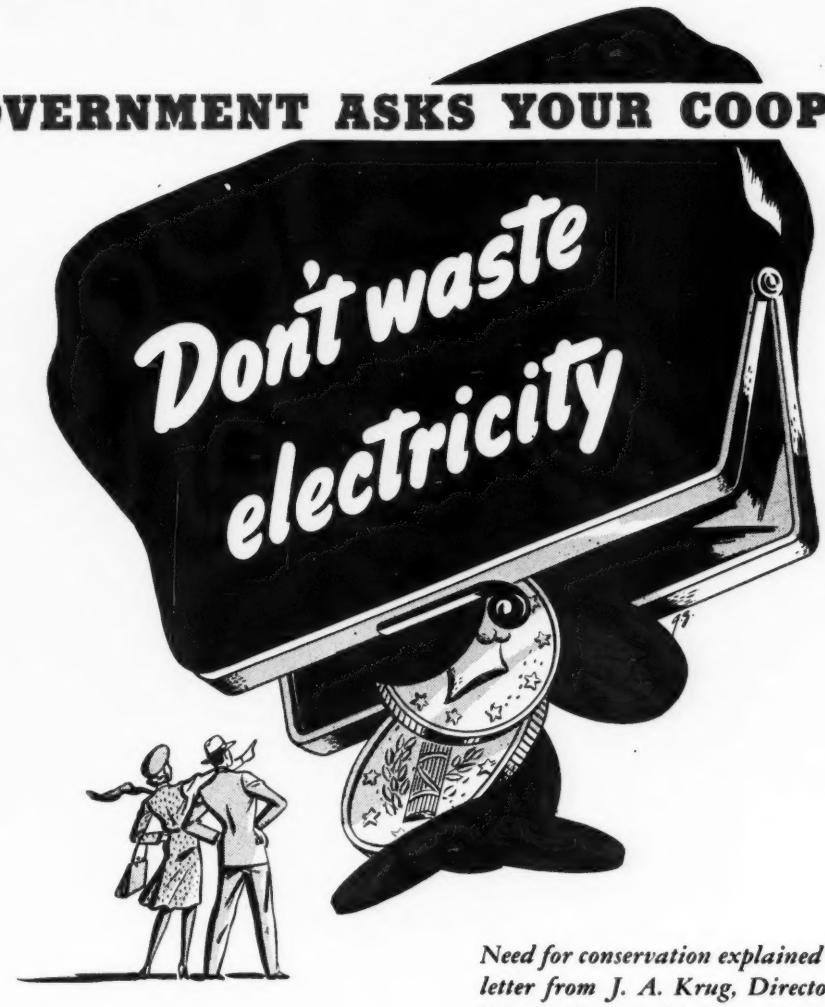
PROFILES *of the month*

Right: Thelma Watson, recently transferred to American Fork as Utah Power & Light Co. home economist for the southern territory. Mrs. Watson previously had served Utah Power & Light in the Ogden and Rexburg divisions and the Western Colorado Power Co.

Below: Lew E. Theaker (left) Southern California Edison lighting consultant at Montebello, and Don K. Grandey (extreme right) power consultant in the Vernon district, have received G-E Bomber Builder awards in the current contest rewarding contribution to wartime lighting. A. L. Laws, Vernon district manager is shown with Grandey. Based on engineering studies, the contest recognizes that, by increasing lighting standards for 1,667 men in a war plant, a salesman has added 100,000 man-hours to their production—enough to build a B-17 Bomber

The display below was set up in Denver's city hall recently to show the advantages of the city's new system. Dana W. Rowten, Public Service Co. of Colorado, is pictured with the exhibit, which included both new and obsolete equipment

YO JR GOVERNMENT ASKS YOUR COOPERATION



Need for conservation explained in a recent letter from J. A. Krug, Director, Office of War Utilities. This letter reads in part:—

"We cannot exert maximum force against our enemies if waste on the home front is tolerated. In the electric utility industry, the installed generating capacity, together with capacity under construction, is ample to meet all foreseeable needs. But it is essential to save the use of electricity wherever possible so as to reduce, directly and indirectly, the demands for *materials, fuel, transportation and manpower.*"

By pledging ourselves to the following platform, this company, its 12,000 employees and its 1,700,000 customers can cooperate as partners in the Conservation Program.

1 We will WASTE NOT so that our fighting men will WANT NOT.

2 We will buy only those home appliances we need and we'll take scrupulous care of everything we own.

3 We will be as careful to avoid wasteful operation of appliances as we are to fix a leaky faucet.

4 We will put every possible dollar of savings into War Bonds and Stamps.

P·G·and E·

PACIFIC GAS AND ELECTRIC COMPANY

IN A MODERN TANK

and

IN A MODERN HOME

Adequate Wiring is Important!

The modern tank is a complex mechanism in which many important operations are electrically controlled. The effectiveness of a tank depends on hair-trigger response to the push of a button or the pull of a lever. The wiring of a modern tank is adequate.

In the modern home, also, electricity controls scores of important operations. Efficiency, economy, satisfactory care-free service, demand that in every instance the response be prompt and automatic. Here, too, adequate wiring is most important.

Adequate wiring sould be a forethought, not an afterthought, for the home-builder of the future. Now, while planning is in progress, is the time to talk adequate wiring. Write today for the facts you will need, to

WASTE IN WAR IS A CRIME . . . DO NOT WASTE ELECTRICITY JUST BECAUSE IT IS NOT RATIONED

PACIFIC COAST ELECTRICAL ASSOCIATION

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